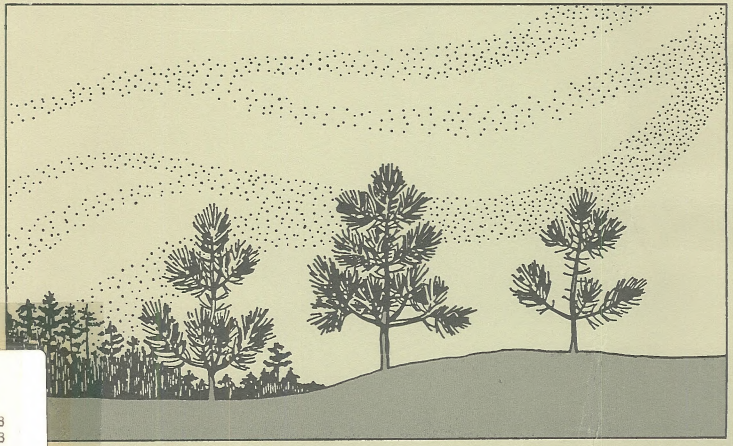
U.S. Department of the Interior
Bureau of Land Management

Draft

Oregon State Office | June 1983

Western Oregon Program - Management of Competing Vegetation

Environmental Impact Statement



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Enclosed for your review and comment is the Draft Environmental Impact Statement (DEIS) for the Western Oregon Program - Management of Competing Vegetation. The statement analyzes the impacts that would result from the proposed action and seven alternatives. The purpose of the statement is to disclose the probable environmental impacts and to assure that these impacts are considered along with economic, technical and other factors in the decisionmaking process. In using this analysis, readers should keep in mind that the EIS (draft or final) is not a decision document. A Record of Decision will follow the final EIS.

This draft may be incorporated into the final EIS by reference only. The final EIS would then consist of public comments and responses and any needed changes in the draft. Therefore, please retain this draft EIS for use with the final.

Comments concerning the adequacy of this statement will be considered in the preparation of the final environmental impact statement. The comment period will end August 15,1983. During the review and comment period public meetings will be conducted at the following times and locations:

July 26, 1983, 7:30 p.m., Grants Pass (County Courthouse)
July 27, 1983, 7:30 p.m., Medford (BLM District Office)
July 28, 1983, 7:30 p.m., Eugene (City Council Chambers)

Comments received after the close of the comment period will be considered in the decision process, even though they may be too late to be specifically addressed in the final environmental impact statement.

Your comments on the EIS should be sent to:

Oregon State Director
Bureau of Land Management
c/o Team Leader
P.O. Box 3227
Salem, Oregon 97302

Recent litigation in the United States District Court for the District of Oregon has resulted in court opinions which would indicate that BLM should go beyond the analysis presented in this document (DEIS) and prepare a worst case analysis of the impacts of herbicide use on human health. (S.O.C.A.T.S. v. Watt, No. 79-1098 and S.O.S. v. Watt, No. 83-6090-E). The first case mentioned is currently under appeal and the second is being considered for appeal to the 9th Circuit Court of Appeal. Depending on the outcome of these appeals, a worst case analysis may be included in the Final EIS.

Sincerely yours,

William G. Leavell
State Director

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Western Oregon Program-Management of Competing Vegetation

Environmental Impact Statement

Prepared by
U.S. Department of the Interior
Bureau of Land Management
June 1983

State Director, Oregon State Office

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Proposed Western Oregon Program for the Management of Competing Vegetation

Draft (X) Final ( ) Environmental Impact Statement

U. S. Department of the Interior, Bureau of Land Management

1. **Type of Action:** Administrative (X) Legislative ( )

2. **Abstract:** This EIS describes and analyzes the environmental impacts of implementing the proposed western Oregon program for the management of competing vegetation. To achieve a high level of timber production on lands in the timber base, harvested lands must be reforested promptly. Control of competing vegetation is necessary to achieve this goal. The alternatives analyzed include: 1) The Proposed Action, 2) Maximum Herbicides, 3) No Burning, 4) Labor-Intensive, 5) Restricted Aerial, 6) No Aerial, 7) No Herbicides and 8) No Action. Alternative 1 (Proposed Action) is the preferred alternative. Significant environmental impacts of the preferred alternative include reduced wildlife habitat diversity, smoke intrusion problems and increased jobs.

3. The draft statement is expected to be filed with the Environmental Protection Agency (EPA) and made available to the public on June 15, 1983. The comment period will be 60 days following transmittal to EPA.

4. **For further information contact:**

Charles E. Hawkins
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U.S. DEPT. OF THE INTERIOR
Bureau of Land Management

WESTERN OREGON DISTRICTS

Summary

Introduction

This environmental impact statement (EIS) describes and analyzes the environmental impacts of implementing a program for managing vegetation which interferes with the survival and growth of commercial tree species, encroaches upon recreation sites and roads, or is toxic to livestock or people. This EIS applies to BLM-administered land in the Coos Bay, Eugene, Medford, Roseburg and Salem Districts.

In accordance with the National Environmental Policy Act, this EIS identifies impacts on the natural and human environment associated with eight alternatives, providing a wide range of options for review and consideration. Alternative 1, The Proposed Action, is the preferred alternative.

Alternatives

The proposed program for managing competing vegetation would include site preparation, plantation maintenance and release, precommercial thinning, roadside maintenance and weed control. Burning, mechanical, manual, chemical and biological methods of control would be available for use under most alternatives. Variables among alternatives include types and amounts of treatments applied to control competing vegetation and constraints on the use of some methods. Sustained yield timber harvest levels (allowable cuts) for Alternatives 1 and 2 are consistent with harvest goals set in the western Oregon BLM timber management EISs or decision documents. Alternatives 3 through 7 would require reductions in harvest levels because fully effective treatments would not always be available to substitute for treatments restricted or excluded under these alternatives. Alternative 8 would reduce harvest levels because competing vegetation would either decrease timber yields or reduce conifer stocking levels on many sites. The alternatives are as follows:

1. The Proposed Action. All approved methods of vegetation control would be available for use in an integrated program. Annual treatments would include approximately 20,000 acres of burning, 41,000 acres of herbicide application, 14,000 acres of mechanical treatments and 17,000 acres of manual treatments. Streamside buffers would be provided in accordance with BLM policy.

2. Maximum Effective Use of Herbicides. Approved herbicides would be used for vegetation management in all cases where herbicides would effectively meet the objectives of specific treatments. In order to reduce costs, herbicides would be applied aerially instead of manually

wherever aircraft could reasonably be used. Streamside buffers would be limited to those required by the Oregon Forest Practices Act. Annual treatments would include approximately 19,000 acres of burning, 53,000 acres of herbicide application, 12,000 acres of mechanical treatments and 11,000 acres of manual treatments.

3. Use of All Vegetation Management Treatments Except Burning. This alternative would be the same as Alternative 1, except burning would be eliminated as a site preparation method. Annual treatments would include approximately 59,000 acres of herbicide application, 26,000 acres of mechanical treatments and 24,000 acres of manual treatments.

4. Emphasis on Use of Effective Labor-Intensive Methods. Labor-intensive manual and chemical methods such as hand clearing, hand cutting and backpack spraying would be used in all cases where they would effectively prepare sites or control competing vegetation. Where these objectives could not be met by manual methods, mechanical and aerial methods would be used. Annual treatments would include approximately 20,000 acres of burning, 34,000 acres of herbicide application, 12,000 acres of mechanical treatments and 28,000 acres of manual treatments.

5. Restricted Aerial Application of Herbicides. This alternative would be the same as Alternative 1, except aerial application of herbicides would be prohibited within one-quarter mile of residences or domestic water diversions in treated drainages. Herbicides could be applied aerially within this one-quarter-mile zone if residents and water users concurred. Annual treatments would include approximately 20,000 acres of burning, 26,000 acreas of herbicide application, 14,000 acres of mechanical treatments and 18,000 acres of manual treatments.

6. Use of All Vegetation Management Treatments Except the Aerial Application of Herbicides. This alternative would be the same as Alternative 1, except herbicide application would be limited to ground methods. Annual treatments would include approximately 21,000 acres of burning, 26,000 acres of herbicide application, 14,000 acres of mechanical treatments and 31,000 acres of manual treatments.

7. Use of All Vegetation Management Treatments Except the Application of Herbicides. All competing vegetation would be controlled through burning and mechanical, manual and biological methods. Herbicides would not be used under any circumstances. Annual treatment would include approximately 20,000 acres of burning, 15,000 acres of mechanical treatments and 45,000 acres of manual treatments.

8. No Management of Competing Vegetation. Sites would be prepared by reducing slash, but scarification would not be used. No treatments to control competing vegetation would take place after planting. No roadside maintenance or weed control would be done. Annual treatments would include approximately 16,000 acres of burning, 11,000 acres of mechanical treatments and 1,000 acres of manual treatments.

Environmental Consequences

Air Quality

The major impacts on air quality from burning would be increases in particulates and visible smoke. Particulate emissions would range from none under Alternative 3 to 10,676 tons per year under Alternative 6. Particulate levels from BLM burning would not be expected to exceed the 150 ug/m^3 National Air Quality particulate concentration standard under any alternative. Some residential areas would likely be impacted by relatively brief visible smoke intrusions under all alternatives except 3. Visible smoke could also intrude into Class I Areas. The probability of visible intrusion would be highest under Alternative 7.

Soils

Burning and/or scarification would cause soil compaction, topsoil removal, dry ravelling and nutrient depletion. A loss of some soil productivity would occur from these impacts under all alternatives. Soil productivity losses would be greatest under Alternative 6 and least under Alternatives 3 and 8.

Water Resources

Suspended sediment and dissolved solids concentrations would be most likely to increase under Alternative 6. Potential for herbicides entering surface water would be greatest under Alternative 3. Water temperatures of small headwater streams would be most likely to increase under Alternatives 1, 2 and 5. None of the alternatives would significantly affect regional streamflow or groundwater movement.

Vegetation

The overall impact of all alternatives would be to suppress competing vegetation, thereby increasing conifer survival and growth. The greatest levels of vegetation control would be provided under Alternatives 1 and 2, which would

include the full range of vegetation management practices and would treat the largest number of acres through burning or herbicide application. Less impact on competing vegetation would occur under Alternatives 3 through 7, which restrict or preclude some treatments. Alternative 8 would least impact competing vegetation, resulting in the lowest level of conifer survival.

Animals

Terrestrial animal populations and diversity would probably decrease under Alternatives 1 through 5, though short-term benefits to some terrestrial animals would occur under all alternatives. Alternatives 1, 2 and 5 would have moderately adverse impacts on animals, particularly big game and song birds, because they would result in the most acres treated and would use the full range of treatment practices. Alternatives 3 and 4 would result in slightly adverse impacts to most terrestrial animals. Alternatives 6 and 7 would probably not reduce animal populations below present levels. Alternative 8 would maintain or slightly increase wildlife diversity by maintaining unaltered early seral stages. Most game fish populations would be expected to decline slightly under Alternative 2 due to reduced requirements for streamside buffers, but populations would not be significantly impacted under the remaining alternatives.

Cultural Resources

Appropriate measures would be taken to identify and protect cultural sites prior to ground-disturbing activities under all alternatives. Undiscovered cultural sites would be susceptible to damage. Once a site is found, however, measures would be taken to minimize or avoid damage. Under all alternatives, sites identified before disturbance would be managed to protect significant scientific and/or interpretive values.

Recreation and Visual Resources

Impacts on recreation and visual resources would be low under all alternatives. Treatments would adversely affect recreational opportunities in some areas, resulting in reduced visitor use.

Special Areas

Vegetation management treatments applied near designated or proposed Research Natural Areas, Outstanding Natural Areas, National Wild, Scenic or Recreation Rivers, National Scenic or Recreation Trails, State Scenic Waterways, State Recreation Trails or Areas of Critical Environmental Concern, would incorporate design features to avoid or mitigate impacts on important resource values.

Human Health

Burning would not be expected to significantly impact human health under any alternative.

Physical injuries such as strains, cuts and fractures would result from treating vegetation with manual and mechanical methods. Injuries would be most likely to occur under Alternatives 3 and 7 and least likely under Alternative 8.

Herbicides proposed for use under this EIS present no significant risks of toxicity to humans when used according to EPA- and State-approved labels. Direct exposure of forest workers to herbicides would be most likely under Alternative 6, and progressively less likely under Alternatives 4, 2, 1, 5, 3, 7 and 8. The probability that the general public would be exposed to herbicides would be greatest under Alternative 3, and progressively less under Alternatives 2, 1, 5, 4, 6, 7 and 8.

Economic Conditions

Compared to 1978-1981, employment and earnings dependent on vegetation management activities would increase under Alternatives 1 through 7. Alternative 2 would yield the greatest increase in employment and earnings in all categories affected by the proposed action. Compared with a continuation of the current program direction, Alternative 7 would increase employment in vegetation control by approximately 180 but would decrease employment in tree planting, wood processing and county government by almost 1,760. Alternative 8 would have significant adverse effects on all employment categories.

Alternative 2 would produce the highest level of public revenue followed by Alternatives 1, 3, 4, 5, 6, 7 and 8.

Social Environment

Some unsettling social effects will occur under all alternatives. Alternatives 2, 3, 6, 7 and 8, which emphasize particular uses or restrictions, are likely to generate some strongly polarized reactions. Alternatives 1, 4 and 5, which incorporate a variety of vegetation management practices in an attempt to respond to a wide range of public attitudes should generate more constructive social impacts.

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Chapter 1 Description of Alternatives Including the Proposed Action

Ponderosa pine

Purpose of and Need for Action

The Bureau of Land Management (BLM) proposes to implement a program for managing competing vegetation in western Oregon. The program will apply to BLM-administered land in Coos Bay, Eugene, Medford, Roseburg and Salem Districts, affecting 18 counties as shown in Table 1-1. These are primarily revested Oregon and California Railroad (O&C) and reconveyed Coos Bay Wagon Road (CBWR) lands. Vegetation management practices proposed in this environmental impact statement (EIS) will be applied to lands which are in the timber base (see Glossary) and lands which are added to the timber base in the future (e.g., through reforestation of brushfields). Those riparian areas which are withdrawn from the timber base will not be treated. Vegetation will also be controlled along roadsides and in recreation sites.

In accordance with the National Environmental Policy Act (NEPA), this EIS identifies impacts on the natural and human environment associated with the proposed action and other alternatives. While the current herbicide program in western Oregon operates under the 1978 EIS *Vegetation Management with Herbicides: Western Oregon -*

Table 1-1 Counties Affected by Action, Acreage[1] and Status of Land Administered by the Bureau of Land Management

County	O&C	Public Domain	Coos Bay Wagon Road	Total BLM
Benton	51,442	6,140	0	57,582
Clackamas	49,991	13,238	0	63,229
Columbia	11,080	1	0	11,081
Coos	98,982	7,756	59,914	166,652
Curry	36,681	30,829	0	67,510
Douglas	611,678	27,160	14,633	653,471
Jackson	389,476	41,434	0	430,910
Josephine	258,971	52,509	0	311,480
Klamath	46,202	4,279[2]	0	50,481[2]
Lane	279,534	10,005	0	289,539
Lincoln	8,773	11,634	0	20,407
Linn	85,601	2,735	0	88,336
Marion	20,786	283	0	21,069
Multnomah	4,247	948	0	5,195
Polk	41,030	643	0	41,673
Tillamook	27,477	21,968	0	49,445
Washington	11,693	321	0	12,014
Yamhill	41,440	1,262	0	42,702
Eighteen-County Region	2,075,084	233,145	74,547	2,382,776

[1] Includes all BLM acres. Approximately 1.7 million of these acres are in the timber base and would be subject to vegetation management under this EIS.

[2] Acres administered by Medford District. Excludes acres administered by Lakeview District.

Source: BLM records.

1978 through 1987, an updated EIS is needed to address the increasing emphasis on nonchemical vegetation management treatments. This EIS will address these nonchemical methods and will also provide more recent information on herbicides.

The Bureau's principal authority and direction to manage the O&C and CBWR grant lands is found in the O&C Act of 1937 (50 Stat. 874; 43 U.S.C. 1181a., et seq.). The disposition of funds derived from the CBWR grant lands is described in an Act approved on May 24, 1939 (43 USC 1181f-I et seq.). Under these Acts, O&C and CBWR lands classified as timberlands are to be managed under sustained yield principles in order to provide a permanent source of timber supply, watershed protection, stream flow regulation and recreational facilities. Intermingled public domain lands were brought under sustained yield management principles by the Bureau's 1969 application to withdraw these lands from entry under all public land laws except certain disposal Acts. Withdrawal was completed by Public Land Order 5490 (40 FR 7450 (1975)). In addition, many activities of the BLM are governed by the Federal Land Policy and Management Act of 1976 (90 Stat. 2743, 43 U.S.C. 1701). This law, often referred to as FLPMA, established policy for BLM administration of public land under its jurisdiction.

Notwithstanding any provision of FLPMA, in the event of conflict with or inconsistency between FLPMA and the O&C Act of August 28, 1937 (50 Stat. 874; 43 U.S.C. 1181a-1181j), and the Act of May 24, 1939 (43 USC 1181f-I et seq.), insofar as they relate to management of timber resources and disposition of revenues from lands and resources, the 1937 and 1939 Acts shall prevail.

Management of competing vegetation is necessary on sites where grass, brush or trees compete with commercial conifers for light, nutrients and/or moisture. The extent and type of competition vary widely throughout western Oregon due to differences in climate, soils and vegetation. Methods of managing competing vegetation vary accordingly, but the need for such management exists throughout the EIS area. This need may also include commercial hardwood lands as they are developed by BLM. Any references to conifer crop trees in this EIS could also include hardwoods on designated commercial hardwood lands.

To achieve a high level of timber production on lands in the timber base, harvested lands must be reforested promptly. Control of competing vegetation increases conifer growth and chances for survival of an acceptable number of well-

spaced trees per acre on as many acres as possible (refer to BLM Manual Supplement 5705 for target stocking standards).

Also addressed in the EIS is noxious vegetation and vegetation which encroaches upon recreation sites and roads. Controlling such vegetation is necessary to improve visibility, maintain public access, prevent road damage, eliminate fire and safety hazards, reduce hazards to livestock and maintain the appearance of recreation sites.

During EIS scoping meetings held in Grants Pass, Medford, Coos Bay, Roseburg, Eugene and Salem, Oregon (between July 7 and July 15, 1982), participants were asked to identify issues and alternatives to be addressed in this EIS. The following section describes alternatives considered appropriate for full analysis. Alternatives identified but not determined appropriate for full analysis, and the rationale for these determinations, are presented in Appendix A, which summarizes the scoping meetings.

Alternatives Including the Proposed Action

There are eight alternatives including the proposed action (Alternative 1, the preferred alternative) for which impacts will be analyzed in Chapter 3. Differences between alternatives include types of treatments, treatment levels, program costs, harvest levels and constraints on vegetation management to benefit other resource values. These relationships are displayed in Table 1-2. Harvest levels discussed in this EIS are proposed or approved levels and are used for comparison purposes only. Actual harvest levels may differ. Descriptions of the alternatives and estimates of treatment acres were developed under the assumption that all alternatives would be attainable (e.g., adequate workforce would be available and weather conditions would not preclude treatment). Treatments and design features applicable to each alternative are discussed in the Vegetation Management Treatments and Design Features section of this chapter.

Sustained yield harvest levels (see Appendix C) for Alternatives 1 and 2 would be consistent with harvest goals set in the western Oregon BLM timber management EISs or decision documents. Effective substitute treatments, if available, would be used where needed. Where alternative treatments would not be feasible or would not meet program objectives, allowable cut estimates would be revised to reflect lower anticipated yields.

Alternative 1: The Proposed Action (PA)

Under this alternative, managers could utilize all approved methods of vegetation management in an integrated program to achieve desired goals (see Table 1-2). This would be the most flexible of the alternatives for making site-specific prescriptions. Burning, herbicide application, scarification (see Glossary) and manual treatments would be used for site preparation. All chemical, manual and biological maintenance treatments would be available. Chemical and manual methods for release and precommercial thinning could be utilized. Roadside vegetation and noxious weeds would be controlled by mechanical, chemical and manual methods. Streamside buffers would be provided in accordance with Oregon BLM policy (see Appendix D). This alternative would be consistent with present Bureau policy on Integrated Pest Management (see Glossary).

Alternative 2: Maximum Effective Use of Herbicides (Max. Herb.)

Approved herbicides would be used for site preparation, stocking maintenance and release, precommercial thinning, roadside maintenance and weed control in all cases where herbicides would effectively meet the objectives of specific treatments. In order to reduce costs, herbicides would be applied aerially instead of manually wherever aircraft could reasonably be used. Streamside buffers would be those required by the Oregon Forest Practices Act (see Appendix E).

Alternative 3: Use of All Vegetation Management Treatments Except Burning (No Burn)

This would be the same as Alternative 1, except burning would be eliminated as a site preparation method. Use of manual, mechanical and chemical methods would be increased to prepare sites and control competing vegetation.

Alternative 4: Emphasis on Use of Effective Labor-Intensive Methods (Lab.-Int.)

Labor-intensive manual and chemical methods such as hand clearing, hand cutting and backpack spraying would be used in all cases where they would effectively prepare sites or control competing vegetation. Where these treatment objectives could not be met by manual methods, mechanical and aerial methods would be used.

Table 1-2 Comparison of Alternatives by Treatment (Annual Estimates)

	Alt. 1[1] (PA)	Alt. 2. (Max. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res.-Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Program Cost ($ millions)[2]	12.5	12.1	15.7	13.4	12.5	14.7	14.8	9.2
Achieve Target Stocking (1,000 ac.)[3]	1,377	1,392	1,231	1,375	1,357	1,174	813	496
Achieve Minimum Stocking (1,000 ac.)[3]	268	253	389	270	284	405	595	730
Below Minimum Stocking (1,000 ac.)[3]	0	0	25	0	4	66	237	419
Treatments[4] (acres)								
Site Preparation								
Mechanical								
Scarification	2,511	2,101	2,559	1,921	2,521	2,621	2,751	0
Piling	420	320	1,460	320	320	400	400	140
Gross Yarding	7,115	6,985	17,008	7,170	7,085	7,085	7,135	10,015
Hydro-axe or Biomass	230	85	1,175	0	230	275	475	0
Manual								
Cutting	1,810	1,590	1,070	2,210	1,720	2,520	2,860	520
Spot Clearing/Scalping	295	270	7,578	1,535	425	450	940	405
Chemical								
Aerial	9,891	12,482	16,980	5,534	8,735	0	0	0
Ground	3,290	3,410	1,727	5,152	1,576	8,876	0	0
Burning	20,001	18,951	0	19,881	20,086	20,336	19,566	16,731
Maintenance and Release								
Manual								
Cutting	1,045	360	1,175	5,470	1,375	12,765	19,617	0
Mulching	288	50	288	648	348	478	5,645	0
Pulling	160	100	180	265	170	240	510	0
Chemical								
Aerial	22,276	24,555	34,989	14,543	20,045	0	0	0
Ground	3,179	3,534	3,294	8,279	4,305	14,663	0	0
Biological								
Seeding	135	100	145	135	135	135	130	0
Animals	330	130	330	330	330	330	330	0
Precommercial Thinning								
Manual	12,528	9,173	12,588	12,628	12,588	12,588	10,961	0
Chemical	140	3,500	140	140	140	140	0	0
Roadside Maintenance								
Mechanical	3,313	2,017	3,313	1,749	3,313	3,313	3,798	0
Manual	772	576	772	4,024	772	772	2,109	0
Chemical	1,853	3,020	1,853	802	1,853	1,853	0	0
Weed Control								
Mechanical	41	41	41	38	41	41	19	0
Manual	52	40	52	77	52	52	115	0
Chemical	274	328	274	242	274	274	0	0

[1] The current program and Alternative 1 have the same range of practices.
[2] No budget ceiling: each alternative is funded in an effort to achieve allowable cut (see Appendix B).
[3] Acres included in the current timber base.
[4] Treatment levels represent estimated average annual acreages for the five western Oregon districts combined. Treatments could be applied on all commercial forest lands. Acres in columns are not additive because some acres would receive multiple treatments.

Alternative 5: Restricted Aerial Application of Herbicides (Res. Aer.)

This alternative would be the same as Alternative 1, except aerial application of herbicides would be prohibited within one-quarter mile of residences or domestic water diversions in treated drainages. Herbicides could be applied aerially within this one-quarter-mile zone if residents and water users concurred. This one-quarter-mile restriction would not apply to ground methods of herbicide application.

Alternative 6: Use of All Vegetation Management Treatments Except the Aerial Application of Herbicides (No Aerial)

This alternative would be the same as Alternative 1, except herbicide application would be limited to ground methods. Increased use of treatments such as backpack spraying and manual cutting would be necessary to meet treatment objectives.

Alternative 7: Use of All Vegetation Management Treatments Except the Application of Herbicides (No Herb.)

Herbicides would not be used under any circumstances. Site preparation would be accomplished by burning, scarification or manual methods. Trees would be planted, and maintenance treatments such as grass/forb seeding, scalping, cutting and mulching would be used. Conifer release, including precommercial thinning, would be limited to manual methods. Recreation site maintenance, roadside vegetation control and weed control would be accomplished by manual or mechanical methods.

Alternative 8: No Management of Competing Vegetation (No Action)

Sites would be prepared by reducing slash sufficiently to alleviate fire hazards and clear areas for planting seedlings. Scarification would not be used. No treatments to control competing vegetation, including precommercial thinning, would take place after planting. No roadside or recreation site maintenance or noxious weed control would be done under this alternative.

Vegetation Management Treatments and Design Features

The purpose of this section is to discuss available treatment methods and protective measures (design features) which will be used in conjunction with them. Table 1-2 displays the types of treatment and treatment levels for each alternative based on an unconstrained budget. Not every treatment listed in Table 1-2 would be applied to every acre. A number of treatment combinations are possible and could be employed. Three to four different kinds of treatment would normally be applied from site preparation through precommercial thinning. Repeated applications of the same treatment would occasionally be required. Where competition is minimal, only one or two kinds of treatment might be required, with no reapplications.

Information on herbicides and carriers proposed for use is presented in Table 1-3. More detailed information can be found in Appendices F and K or in *Environmental Fates and Impacts of Forest Use Pesticides* (Ghassemi et al. 1981), *Herbicide Background Statements* (USDA, FS 1981), *Transmission Facilities Vegetation Management Program Draft EIS* (USDE, BPA 1982) and *Environmental Effects of Vegetation Management Practices on DNR Lands* (Newton and Dost 1981). Herbicides would be applied and monitored in accordance with the *Field Guide to Policies and Procedures Required for Vegetation Management with Herbicides in Western Oregon* (USDI, BLM 1981a) (see Appendix D), except that requirements for streamside buffers would be less restrictive under Alternative 2.

Some treatment needs for site preparation and stand maintenance would be identified during timber sale planning. Other vegetation management treatment needs would be identified after harvest operations were completed, during initial and subsequent surveys. Before a decision is made to use herbicides on a specific tract, pre-treatment surveys would be done in accordance with the Field Guide (USDI, BLM 1981a) and would include consideration of all feasible treatments, including potential impacts, effectiveness and cost (see Appendix D). Information from these surveys would be used as a basis for prescribing silvicultural treatments and for writing environmental assessments.

Most treatments would be accomplished through service contracts awarded on a competitive basis. To comply with applicable laws, regulations and policies, contractors would be governed by

Table 1-3 Herbicide Use by Alternative - Estimated Annual Acreages

Chemical[1]	Carrier	Application Rate[2] (lbs./acre)	Alt. 1 (PA)	Alt. 2. (Max. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)
Site Preparation - Aerial								
Atrazine	Water	3-4	250	275	250	200	150	0
Atrazine + Dalapon	Water	3-4.4, 4-5	4,148	4,459	3,931	1,871	3,665	0
Atrazine + Dalapon + 2,4-D	Water	3-4, 3-4, 1-3	383	523	933	383	355	0
Atrazine + 2,4-D	Water	3-4, 2-3	100	100	200	25	50	0
Asulam	Water	1.6	65	65	30	65	65	0
2,4-D	Water	2-4	250	500	300	125	200	0
2,4-D	Oil & Water	2-4	400	500	1,180	400	400	0
2,4-D	Oil	2-4	40	40	260	60	40	0
2,4-D + Triclopyr ester	Oil & Water	4-8, 3-4	50	50	150	50	50	0
Triclopyr ester	Water	1-8	995	2,090	4,377	855	805	0
Triclopyr ester	Oil & Water	4-8	150	300	350	0	150	0
Triclopyr ester	Oil	2-5	270	430	1,225	80	180	0
Glyphosate	Water	1.5-5	1,295	1,495	1,750	640	1,280	0
Triclopyr ester + Glyphosate	Oil	2,1	45	45	264	45	45	0
Triclopyrester + Glyphosate	Water	2,1	45	45	264	45	45	0
Hexazinone	Water	1-2	1,270	1,370	1,345	655	1,120	0
Picloram	Water	4-5	75	75	110	10	75	0
Dalapon	Water	4-5	10	10	10	0	10	0
Picloram + Triclopyr ester	Water	4-8, 3-4	50	90	50	25	50	0
Fosamine Ammonium	Water	5-12	0	20	0	0	0	0
Site Preparation - Ground								
Atrazine	Water	3-4	25	25	20	75	50	75
Atrazine + Dalapon	Water	3-4.4, 4-5	295	265	345	2,735	625	4,952
Atrazine + Dalapon + 2,4-D	Water	3-4, 3-4, 1-3	0	50	0	0	0	185
Atrazine + 2,4-D	Water	3-4, 2-3	0	50	0	75	0	100
Asulam	Water	1.6	0	0	40	5	0	65
2,4-D	Water	2-4	0	0	30	200	50	50
2,4-D	Oil	2-4	0	0	0	10	0	20
2,4-D	Oil & Water	2-4	30	0	30	60	65	50
2,4-D + Triclopyr ester	Oil & Water	2-4, 1-3	0	0	0	0	0	20
Triclopyr ester	Oil	2-5	20	60	50	160	40	140
Triclopyr ester	Water	2-8	0	0	0	357	10	0
Triclopyr amine	Water	1-5	2,410	2,435	757	125	100	225
Triclopyr amine	Undiluted	1-2	200	190	60	120	30	60
Glyphosate	Water	0.5-5	185	185	205	850	311	2,469
Hexazinone	Water	1-2	40	50	50	310	155	300
Picloram	Water	0.1-3.8	50	80	80	40	80	105
Dalapon	Water	4-5	10	10	10	20	10	10
Picloram + Triclopyr ester	Water	2-4, 1-3	25	10	50	10	50	50
Maintenance & Release - Aerial								
Atrazine	Water	3-4	130	130	237	130	210	0
Atrazine + Dalapon	Water	3-4.4, 3-5	2,073	2,222	2,502	1,430	1,955	0
Atrazine + Dalapon + 2,4-D	Water	3-4, 3-4, 1-3	220	220	401	220	300	0
Atrazine + 2,4-D	Water	3-4, 2-3	100	100	100	100	150	0
Asulam	Water	1.5	290	290	590	0	290	0
2,4-D	Water	1.5-3	3,800	4,420	4,084	2,620	3,045	0
2,4-D	Oil & Water	1.5-3	2,552	2,507	3,321	1,492	2,630	0
2,4-D	Oil	1.5-3	1,275	600	640	480	575	0
2,4-D + Triclopyr ester	Oil & Water	1-3, 1-3	200	0	0	0	0	0
Triclopyr ester	Water	1-4	1,690	2,895	5,820	1,513	1,970	0
Triclopyr ester	Oil & Water	1-2	310	580	1,920	510	400	0
Triclopyr ester	Oil	1-2	2,530	2,830	5,350	1,593	2,200	0
Glyphosate	Water	1-3	6,008	6,633	8,326	3,605	5,290	0
Triclopyr ester + Glyphosate	Water	1,1	300	300	820	200	300	0
Hexazinone	Water	1-2	768	798	828	650	700	0
Fosamine Ammonium	Water	3-4	30	50	50	0	30	0

Maintenance & Release - Ground								
Atrazine	Water	3-4	0	15	0	0	0	55
Atrazine + Dalapon	Water	3-4.4, 3-5	320	80	355	1,511	480	2,900
Atrazine + Dalapon + 2,4-D	Water	3-4, 3-4, 1-3	150	120	200	500	100	100
Atrazine + 2,4-D	Water	3-4, 2-3	0	0	0	300	50	100
Asulam	Water	1-6	30	30	0	30	30	30
2,4-D	Water	1.5-4	90	90	170	390	465	1,960
2,4-D	Oil & Water	1.5-3	50	50	50	140	235	875
2,4-D	Oil	1.5-4	20	20	20	114	44	354
2,4-D + Triclopyr ester	Oil & Water	1-3, 1-3	0	30	0	0	0	55
Triclopyr ester	Water	1-4	160	140	180	260	440	626
Triclopyr ester	Oil & Water	1-2	50	0	50	250	100	350
Triclopyr ester	Oil	1-4	1,214	1,179	1,419	1,400	1,120	1,870
Triclopyr amine	Water	1-2	40	3,255	40	140	40	1,200
Triclopyr amine	Undiluted	1-5	130	200	160	250	150	200
Triclopyr amine	Oil & Water	1-2	80	80	80	0	38	80
Glyphosate	Water	1-5	405	480	330	1,794	613	3,363
Triclopyr ester + Glyphosate	Water	2,2	0	0	0	0	0	60
Hexazinone	Water	1-2	130	120	100	210	130	205
Picloram	Water	1-4	150	185	110	210	250	250
Picloram + Triclopyr ester	Water	5, 5	0	750	0	750	0	0
MSMA	Water	1-2	140	280	140	140	140	140
Dicamba	Oil	1.5	20	20	20	20	20	20
Fosamine Ammonium	Water	4	0	10	10	10	0	10
Roadside Spray & Weed Control								
2,4-D	Water	1.5-3	50	50	50	30	50	50
2,4-D + Triclopyr ester	Oil & Water	1-3, 1-3	363	537	363	442	363	363
Triclopyr ester	Water	1-5	1,158	1,741	1,158	16	1,158	1,158
Dicamba	Water	2-3	200	238	200	300	200	200
Diuron	Water	8-16	158	158	158	50	158	158
Diquat	Water	2	7	0	7	7	7	7
Ammonium sulfamate	Water	1-1.5	3	0	3	3	3	3
Undecided		-	0	385	0	0	0	0

[1] Does not include all types, brands or formulations of herbicides currently registered by EPA for forestry use.

[2] Active ingredients (in total pounds) applied may be figured by multiplying the application rate by the estimated acres under each alternative. Application rates shown reflect the range of different application rates used in western Oregon. All applications are limited to label specifications.

performance standards set forth in the standard and special provisions of contracts. Special provisions for a contract would be selected in accordance with the scope of the action, accepted mitigation measures and the physical characteristics of the specific site. Bureau manuals, manual supplements and field guides provide a variety of approved standard and special provisions for use in individual contracts. These provisions would be modified if analyses in this EIS or future environmental documents indicate a need for change.

Prior to any vegetative treatment or ground disturbance, BLM requires a survey of the project site for plants and animals listed or proposed for listing as threatened and endangered species (see Glossary). If a project might affect any listed or proposed Federal threatened or endangered species or its critical habitat, every effort would be made to modify, relocate or abandon the project in order to obtain a no-effect determination. If BLM determines that a project cannot be altered or abandoned, consultation with the U.S. Fish and Wildlife Service would be initiated (50 CFR 402; Endangered Species Act of 1973, as amended).

Whenever evidence of historic or prehistoric occupation is identified during BLM activities, special surveys are undertaken to determine possible conflicts in management objectives. In addition, a Class III (complete) cultural resources inventory is required on all areas to be subjected to ground disturbing activities. This is accomplished in the pre-planning stage of a treatment, and the results are analyzed in the environmental assessment addressing the action (BLM Manual 8100, Cultural Resource Management). When a cultural resource is discovered during vegetation management activities which might adversely impact that resource, operations in proximity are immediately suspended and may only resume upon receipt of written instructions from the BLM authorized officer. Procedures under 36 CFR 800 would be followed, including consultation with the State

Historic Preservation Officer in the determinations of eligibility, effect and adverse effects.

Site Preparation

Site preparation treatments are used to prepare newly harvested or inadequately stocked areas for planting a new crop of trees. The primary treatment objectives are to provide planting spots and planting crew access by reducing slash and to improve plantation success by reducing vegetation that competes with conifers. Four methods of site preparation (burning, chemical, mechanical and manual) are planned for use on BLM-administered lands in western Oregon.

The most common site preparation treatment would be burning, included in all alternatives except Alternative 3 (Table 1-2). Broadcast burning clears areas for planting, reduces fire hazard and reduces competing vegetation. Slash piles are burned to reduce habitat of animals that damage conifers. Burning would be done when weather and fuel conditions are favorable, usually between March and November. It would occur only at times approved by the Oregon State Department of Forestry, which administers the Smoke Management portion of the State's Air Quality Implementation Plan.

All burning would be conducted in accordance with Fire Management Policy (BLM Manual 9210) which requires the preparation of a prescribed burning plan in advance of every burn. The fire plan tailors each burn to specific requirements of the site. It addresses physical characteristics of the burn area, objectives of the burn, fuels on site (loading and characteristics), weather conditions under which the plan will be implemented, expected fire behavior, air and water quality restrictions, lighting sequence, emergency fire suppression plan, equipment and personnel needs, public contacts and safety.

Two methods of igniting prescribed burns are normally used by the BLM in western Oregon. Drip torches are used to apply a burning mixture of diesel fuel and gasoline by hand. Gelled gasoline (see Glossary) is applied to broadcast burn areas by helicopter-carried drip torch (see Glossary), and is applied to piles by hand. When using hand-carried drip torches, individuals traverse the burn area in a specified pattern developed in advance of the prescribed burning plan. By tailoring traverse patterns to each burn area, effectiveness, maximum safety and control can be maintained. When using helicopter-carried drip torches, individuals are generally not used to manually light any of the burn area except possibly along firelines where the helicopter cannot reach.

Helicopters are commonly used on steep, slash-covered units where manual lighting would be hazardous for individuals, or on units that are very large and require the speed of helicopter lighting to accomplish the goal.

Site preparation treatments using herbicides (Table 1-3) are included in all alternatives except Alternatives 7 and 8. Herbicides are used to increase plantation survival rates by controlling grasses, forbs, brush and noncommercial tree species prior to planting. These treatments improve the potential for success by reducing competition for light, moisture and soil nutrients. In some cases, herbicides would be applied prior to burning to dessicate vegetation, creating drier fuels for improved combustion.

Stage of plant growth and season of application are especially important in prescribing herbicide treatments. All plants exhibit seasonal changes in susceptibility to herbicides, and these changes vary widely in western Oregon. Information on the most effective timing of applications is found in published research and on individual herbicide labels.

Herbicides are applied in a number of ways depending upon the treatment objective, topography of the treatment area, target species, crop species, anticipated costs, equipment limitations and potential environmental impacts. Aerial application is done by helicopters. Ground application is accomplished through injection, backpack spraying, vehicle-mounted spray systems and stump treatment. Injection involves cutting slits in the stems of target plants and applying herbicide into the slits using hand-held containers or injectors. Backpack systems use either a pressurized sprayer or a powered mist blower to apply herbicides as a broadcast spray or directly to individual plants or small concentrations of plants. Vehicle-mounted spray systems incorporate hand-held spray nozzles or fixed nozzles and can be used to treat some flat areas. Stump treatment normally involves the direct application of liquid herbicides to stumps.

In mechanical site preparation, machines are used to provide access to planting spots and reduce competing vegetation. Mechanical methods would be used under all alternatives, except that scarification would not be used under Alternative 8. The acres identified for treatment are shown in Table 1-2. In western Oregon, the most common methods consist of scarification and piling or windrowing of slash, brush and unmerchantable trees, using a tractor equipped with a brush blade. Occasionally, circumstances require the use of specially designed mowing attachments or machines (e.g., Hydro-axe) which cut or crush all vegetation on the site. Use of tractors would be

Applying herbicides with backpack sprayer

restricted to slopes less than 35 percent with low soil moisture and suitable soil types.

While not normally defined as a site preparation method, gross yarding (see Glossary) of unmerchantable material during or following logging operations is sometimes used to reduce fire hazard, improve access to planting spots and reduce smoke if the site is burned.

Manual methods of site preparation utilize hand labor to remove competing vegetation and prepare planting spots. Manual methods are normally used where they are effective and where environmental reasons preclude the use of burning, herbicides or mechanical methods. Acres identified for manual site preparation are shown in Table 1-2. Manual methods used in western Oregon include hand cutting and clearing.

Hand cutting and clearing is done with hand tools, including power saws. It involves activities such as scalping (see Glossary), cutting stems of competing vegetation and cutting holes in slash concentrations to clear spots for planting. Hand cutting of green brush is occasionally done prior to burning to increase amounts of dry fuels and improve results of burning.

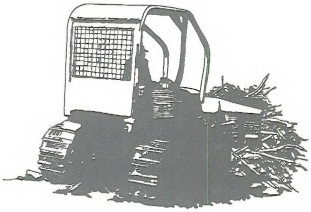
Plantation Maintenance and Release

Vegetation management practices which are applied after planting are termed either maintenance or release treatments. Maintenance treatments promote the survival and establishment of conifer seedlings. Release treatments reduce competition between shrubs or grass and existing commercial conifer seedlings and promote dominance and growth of established conifers.

Fast-growing brush and hardwoods such as vine maple, ceanothus, red alder and tanoak overtop and suppress slow-starting conifer seedlings. Brush and hardwoods grow rapidly, shutting out essential light and competing for water during the dry summer. On most sites, grass and forbs also compete effectively for water. The degree and type of competition vary by site. With reduced competition, conifers grow beyond the point where they can be overtopped and further suppressed by surrounding vegetation. When this growth is achieved (approximately 3 to 10 years from planting), no further control of competing vegetation is necessary except precommercial thinning.

The primary methods of maintenance and release are mulching, hand pulling and cutting and herbicide application. Occasionally, scalping, grazing and grass/forb seeding are also used (Table 1-2).

Mulching involves covering the ground with paper, plastic or other material to prevent growth of competitors around seedlings. It is used primarily in areas of southwestern Oregon where grass is the primary competitor.



Scarification and piling

Hand pulling is possible only for plants arising from seed and is not effective on sprouted brush with well developed root systems. It is primarily used on young ceanothus, scotch broom and manzanita prior to the second growing season.

Hand cutting for maintenance and release is the same as that for site preparation, except it is limited to cutting of competitive brush and hardwood species, usually in proximity to conifers. Cost and biological effectiveness are highly dependent on terrain, soils, season of treatment, age and size of conifers to be released and the species, age, quantity and size of target vegetation.

Herbicides have been used effectively to inhibit the growth of vegetation competing with conifers. The use of herbicides for maintenance and release is included in all alternatives except Alternatives 7 and 8. Table 1-3 shows chemicals to be used and estimated acreage to be treated. In addition to the application methods identifed under Site Preparation, the following information (from Gratkowski 1975) concerning the timing of applications is specific to herbicide maintenance and release spray programs.

Correct timing in applying herbicide sprays is essential in releasing young conifers from brush and grass competition. As a result of physiological differences between hardwoods and conifers, many brush species and unwanted hardwood trees are susceptible to herbicide sprays during periods when conifers are resistant. Maintenance and release sprays are applied during five periods of the year when they will control competing vegetation with minimum adverse effect to conifers. These periods are bud break, early foliar, late foliar, late summer and fall. Conifers are closely observed before and during all herbicide operations to determine correct timing of application and hold damage to negligible levels. Stump treatments or individual tree injection methods may take place at any time of the year.

Hand cutting competing vegetation

Bud-break sprays are usually applied in late winter or early spring after brush and hardwoods begin growth, but before bud break of the conifers. Oil carriers are used to facilitate absorption of herbicides through the bark of stems and branches. Early foliar sprays are applied in late spring after approximately three-fourths of the new leaves on brush species and hardwoods are fully developed. For conifer maintenance and release during this period, sprays are applied primarily in water carriers. Late foliar sprays are applied primarily in early summer after brush species have ceased active growth, all leaves have fully developed and hardened and terminal buds have formed. Late summer sprays are applied in late July through September, long after most brush species and conifers have ceased growth. Fall sprays are applied from September through November as a plantation maintenance treatment to control grasses and forbes in southwestern Oregon.

Sheep grazing, scalping and grass/forb seeding are occasionally used to manage vegetation competing with conifer seedlings. Sheep, when properly managed, can be effective in reducing low brush without damaging conifers (Newton and Dost 1981), particularly in some pine plantations. In scalping, all vegetation is removed with a hand tool, exposing mineral soil. Selected grasses and forbs can be seeded on units immediately after burning or scarification, quickly covering exposed mineral soil. This retards or prevents the invasion of light-seeded brush and hardwood species. This method is only effective in vegetation zones where there is little or no competition for moisture. In such areas, grasses and forbs have little effect on conifer survival and growth compared to losses caused by brush and hardwoods.

Precommercial Thinning

Precommercial thinning is normally applied to conifer stands between 10 and 20 years of age which contain over 500 stems per acre. Precommercial thinning reduces competition and promotes vigorous growth of desirable trees by removing excess trees, trees of inferior form or quality and trees of less desirable species.

The number of trees cut per acre during precommercial thinning is dependent on the density of the stand before thinning. While average spacing is approximately 12 feet, the number of crop trees left may vary between 200 and 320 per acre. Contract specifications, emphasized by field instructions to crews, cover desired spacing of crop trees and criteria for crop tree selection.

The primary method of precommercial thinning is cutting trees with a power saw. The injection of herbicides using specially designed tools is another method available. Acres identified for treatment under each alternative are shown in Table 1-2.

Roadside Maintenance and Weed Control

Vegetation control along roadsides is done primarily by BLM crews. Its purpose is to remove vegetation from ditches and shoulders of roads to prevent brush encroachment into driving lanes, maintain visibility on curves for the safety of vehicle operators, permit drainage structures to function as intended and facilitate maintenance operations. It is usually accomplished using mechanical methods and herbicides, although some clearing is done manually.

Mechanical cutting is usually done with a mowing device mounted on a truck, tractor or grader. Manual methods of brush cutting are the same as described under Site Preparation. Herbicides are normally applied with vehicle-mounted sprayers incorporating hand-held or fixed nozzles.

Weed control encompasses a variety of activities including maintenance of recreation sites and hiking trails and control of noxious plants harmful to humans or domestic livestock.

Plants most often treated are poison oak, tansy ragwort, St. Johnswort, skeleton weed, thistle and blackberry. Methods of control are similar to those described under Site Preparation and Plantation Maintenance and Release. Herbicides are not used for recreation site maintenance on peak visitation days.

Comparison of Impacts

This section compares in tabular form (Table 1-4) the impacts of each alternative. While impacts are described in detail in Chapter 3, Table 1-4 is presented to assist decisionmakers and reviewers by summarizing the impacts of each alternative.

Implementation

Final Decisions

Thirty days after issuance of the final EIS, public comment on the draft and final EISs will be evaluated, and preparation of a Record of Decision will begin. The decision may be to select one of the alternatives intact or to combine features from several alternatives that fall within the range of actions analyzed in the EIS. Significant impacts, alternatives, environmental preferences and economic and technical considerations will be addressed in the Record of Decision.

Monitoring and Studies

Currently, most vegetation management treatments are monitored through administration of contracts under which the practices are authorized. Continuous administration of active slash burning and herbicide spraying contracts is required. Before and after spraying, water samples are taken from selected adjacent streams (see Appendix D). Precommercial thinnings, manual vegetation control or scarification projects are monitored at regular intervals to determine the quality and quantity of completed work. Prescribed burns are monitored in progress, and the effectiveness of burns is assessed in post-burn evaluation reports. Vegetation management at most recreation sites and along roads and hiking trails is routine maintenance work conducted and monitored by Bureau employees.

Silvicultural effectiveness of vegetation management treatments would be monitored primarily through a series of inventories and surveys (USDI, BLM 1981a). Information collected would be used to determine the need for and success of particular treatments. For example, vegetative survey data collected over a period of years could be used to quantify the effects of treatments on competing vegetation and desired tree species.

Two important programs in western Oregon involve the cooperation of government (including BLM) and private agencies in studying vegetation management practices. The FIR Program (Forestry Intensified Research) is concentrating on practices in southwestern Oregon,,while the CRAFTS Program (Coordinated Research on Alternative

Table 1-4 Summary of Impacts

Environmental Component Impacted	Existing Situation	Alt. 1 (PA)	Alt. 2 (Max. Herb.)	Alt. 3 (No Burn)
Allowable Harvest (MMBF)	----------	1,166	1,188	1,148
Air Quality	Occasional smoke intrusions occur, but none has exceeded EPA particulate standards.	Moderate increase in smoke intrusions expected, but EPA standards would not be exceeded.	Approximately the same impacts as Alt. 1.	No smoke intrusions would occur. Overall air quality would improve.
Soils				
Scarification/Piling	An estimated 15% productivity loss occurs on about 4,800 acres treated each year.	Productivity losses would occur on 38% fewer acres treated each year.	Productivity losses would occur on 40% fewer acres treated each year.	Productivity losses would occur on 9% fewer acres treated each year.
Burning	Productivity losses cannot be quantified. Impacts are proportional to the number of acres burned (about 13,600 acres annually.)	Productivity would be affected on 54% more acres burned each year.	Productivity would be affected on 48% more acres burned each year.	Productivity losses would be eliminated.
Water Quality				
Suspended sediments	Usually less than 100 mg/l from all sources.	Slight increases are likely.	Slight increases are likely.	Levels are likely to decline.
Dissolved Solids	Usually less than 100 mg/l from all sources.	Slight increases are likely.	Slight increases are likely.	Levels are likely to decline.
Herbicide residues	About 80% of current samples contain no residues. Residues in remainder of samples are below significant levels.	Numbers of samples containing residues would double, but residues would be below significant levels.	Numbers of samples containing residues would double, but residues would be below significant levels	Numbers of samples containing residues would triple, but residues would be below significant levels.
Temperature	----------	Slight increases are likely.	Slight increases are likely.	Slight decreases are likely.
Vegetation Habitat Altered by				
Mechanical treatment (ac/yr)	12,043	10,276	9,491	22,202
Manual treatment (ac/yr)	8,280	16,590	10,702	23,573
Chemical treatment (ac/yr)	18,481	38,746	48,937	56,865
Burning (ac/yr)	13,498	20,001	18,951	0
Animals				
Big Game	Populations are at moderate levels.	Moderate reductions in existing big game population levels would occur.	Impacts would be approximately the same as under Alt. 1.	Impacts would be approximately the same as under Alt. 1.
Cavity Nesters Song Birds and Small Mammals	Populations are at moderate levels and are declining.	Reductions in habitat diversity, snags and downed material would moderately reduce small mammal, woodpecker and song bird populations from existing levels.	Impacts would be approximately the same as under Alt. 1.	Impacts would be approximately the same as under Alt. 1, except populations of cavity nesters and small mammals would be only slightly reduced.
Fish	Most habitat is in fair to good condition. Around 40% of coho salmon habitat is in poor condition. Streams producing at 50% of optimum.	Habitat conditions and population levels would remain unchanged.	Habitat conditions and population levels would decline slightly.	Approximately the same impacts as under Alt. 1.
Cultural Resources (unidentified sites)	----------	Low probability of site damage.	Low probability of site damage.	Low probability of site damage.
Scenic Quality	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.
Special Areas (sites)	----------	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.
Human Health	Not significantly impacting human health.	Negligible probability of impact.	Negligible probability of impact.	Negligible probability of impact.
Social Environment	----------	Likely to generate more constructive social impacts.	Likely to generate strongly polarized reactions.	Approximately the same impacts as under Alt. 2.
Economic Conditions[1]				
Impacts Compared to Existing Condition				
Total Earnings ($ millions)	540	+49	+49	-39
Total Employment (FTE)[2]	38,730	+2,545	+2,561	+1,237
Public Revenue ($ millions)[3]	82.98	-33.0	-33.1	-34.9
($ millions)[4]	40.28	-16.9	-17.1	-53.2
Impacts Compared to Current Program Direction (Alt. 1[5])				
Total Earnings ($ millions)	589	0	0	-9
Total Employment (FTE)[2]	41,275	+16	+16	-509
Public Revenue ($ millions)[3]	49.8	+0.1	+0.1	-1.7
($ millions)[4]	109.9	+0.2	+0.2	-4.7

[1] See Chapter 3, Economic Conditions for discussion of existing condition and current program direction.
[2] One full-time equivalent (FTE) work year equals 220 work days.
[3] Based on 926 per MBF.
[4] Based on 3287 per MBF.
[5] Impacts under Alternative 2 through 6 are in relation to earnings, employment and revenues displayed under Alternative 1.

Alt. 4 (Lab.-Int.)	Alt. 5 (Res.-Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
1,185	1,151	1,122	957	818
Approximately the same impacts as Alt. 1.	Approximately the same impacts as Alt. 1.	Approximately the same impacts as Alt. 1.	Approximately the same impacts as Alt. 1.	Slight increase in smoke intrusions expected, but EPA standards would not be exceeded.
Productivity losses would occur on 46% fewer acres treated each year.	Productivity losses would occur on 40% fewer acres treated each year.	Productivity losses would occur on 34% fewer acres treated each year.	Productivity losses would occur on 26% fewer acres treated each year.	Productivity losses would be virtually eliminated.
Approximately the same impact as Alt. 1.	Approximately the same impact as Alt. 1.	Productivity would be affected on 50% more acres burned each year.	Productivity would be affected on 31% more acres burned each year.	Productivity would be affected on 29% more acres burned each year.
Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.
Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.
Numbers of samples containing residues would slightly increase, but residues would be below significant levels.	Numbers of samples containing residues would slightly increase, but residues would be below significant levels.	Numbers of samples containing residues would decrease. Residues would be below significant levels.	Residues would be virtually eliminated.	Residues would be virtually eliminated.
Increases are less likely than under Alts. 1 and 2.	Slight increases are likely.	Changes would be negligible.	Changes would be negligible.	Slight decreases are likely.
9,411	10,156	10,361	10,751	10,155
23,430	17,062	29,550	46,872	955
32,730	34,766	24,552	0	0
19,861	20,066	20,330	19,566	16,731
Populations would be slightly reduced from existing levels.	Impacts would be approximately the same as under Alt. 1.	Populations would remain approximately the same as present levels.	Impacts would be approximately the same as under Alt. 5.	Populations should remain at existing levels or increase slightly.
Populations of small mammals, woodpeckers, and song birds would decline slightly but not as much as under Alt. 1.	Impacts would be approximately the same as under Alt. 1.	Populations of small mammals, woodpeckers and song birds would remain approximately the same as present levels.	Impacts would be approximately the same as under Alt. 6.	Increases in habitat diversity, snags and downed material would maintain or slightly increase small mammal, woodpecker and song bird populations.
Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 1.	Approximately the same impacts as Alt. 1.
Low probability of site damage.	Low probability of site damage.	Low probability of site damage.	Low probability of site damage.	Negligible probability of site damage.
Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.
Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Negligible probability of degradation.
Negligible probability of impact.	Negligible probability of impact.	Negligible probability of impact.	Negligible probability of impact.	Negligible probability of impact.
Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 2.	Approximately the same impacts as under Alt. 2.	Approximately the same impacts as under Alt. 2.
+50 +2,697	+46 +2,480	+36 +1,785	-5 -492	-45 -3,852
-33.3 -59.7	-33.4 -56.5	-35.9 -49.4	-42.7 -30.5	-46.3 +14.6
+1 +152	-1 -78	-13 -757	-54 -3,537	-94 -6,387
-0.0 -0.1	-0.2 -0.5	-2.6 -7.4	-9.5 -36.5	-15.1 -42.4

Forestry Treatments and Systems) coordinates most vegetation management research in the Pacific Northwest.

Impacts that vegetation management treatments have on other resources would also be monitored. Currently, the Oregon Department of Environmental Quality monitors air quality by measuring particulate levels in the atmosphere. Water quality monitoring would be carried out in accordance with Executive Orders 11514 (partially amended by 11991) and 12088, Sections 208 and 313 of the Clean Water Act, BLM Manual 7240 and Oregon Department of Environmental Quality Memorandum of Understanding (MOU-OR 158). Additional monitoring systems for other resources (watershed, wildlife, etc.) as identified and outlined in the final decision will be developed and implemented. Effectiveness of mitigating measures identified in environmental assessments will be monitored through periodic inspections of selected projects.

Requirements for Further Environmental Analysis

This EIS is a regional programmatic statement for managing competing vegetation on BLM-administered lands in western Oregon and is intended to be applicable for approximately 5 to 10 years. Site-specific environmental analysis and documentation (including application of categorical exclusions where appropriate) will be accomplished annually by each district on proposed vegetation management plans. Interdisciplinary impact analyses will be based upon this and other applicable EISs. Chemicals authorized for forestry applications after publication of this EIS will undergo analysis and documentation prior to use on BLM-administered lands.

If analysis indicates potential for significant impacts not already described in an existing EIS, another EIS or a supplement to an existing EIS may be required.

Interrelationships

Due to the scattered nature of BLM-administered land in western Oregon, coordination of vegetation management activities with adjacent landowners and managers is essential. BLM also works closely with other government agencies responsible for special resource management programs. The following subsections provide a brief description of major interrelationships involving vegetation management.

Federal Government

The western Oregon BLM districts share in part common boundaries with several national forests. Coordination between district managers, forest supervisors and staffs is routine. Specific project and program coordination takes place as needed between all management levels of each agency.

The U.S. Environmental Protection Agency (EPA) has responsibility for herbicide registration (40 CFR 162). This includes responsibility for determining that a herbicide will not generally cause unreasonable adverse effects on the environment. EPA's determinations are based upon research data supplied by the applicant for registration.

The U.S. Fish and Wildlife Service administers the Endangered Species Act of 1973 (as amended). Accordingly, BLM consults with that agency when it is determined that a Federally listed or proposed threatened or endangered species or its critical habitat may be affected. The purpose of consultation is to avoid adverse impacts to the species in question. Such consultation may result in modification or abandonment of an action.

The National Park Service (NPS) administers the Nationwide Rivers Inventory, as provided under the National Wild and Scenic Rivers Act of 1968. Present efforts are directed toward inventory and evaluation to determine which free-flowing rivers and river segments are suitable for possible designation as components of the National Wild and Scenic Rivers System. BLM consultation with NPS is required if proposed management actions could alter a river's ability to meet established Wild and Scenic Rivers Act eligibility and/or classification criteria.

State and Local Governments

Section 202(c)(9) of the Federal Land Policy and Management Act requires BLM to develop resource management programs consistent with those of State and local governments to the extent that such BLM programs are also consistent with Federal law and regulations. BLM coordination efforts involve a number of State and local administrative and planning agencies as highlighted below.

The Intergovernmental Relations Division for the State of Oregon is the Clearinghouse for State agencies. Notices of all major BLM proposed actions are provided for coordinated State level review by the State Clearinghouse. Areawide clearinghouses (see Appendix G) coordinate the

review of proposed BLM activities by county and local governments in their respective areas of interest.

In accordance with a Memorandum of Understanding (MOU-OR 56), the Oregon State Department of Agriculture Pesticide Use Clearinghouse has been established to assist in the review of herbicide use proposals by Federal, State and industry organizations. The signatory members to the Memorandum of Understanding will review all proposals made by the Bureau in Oregon.

Close relations have been established with the Oregon Department of Land Conservation and Development to ensure cooperation and coordination of BLM programs and planning efforts with those conducted by county and local governments under Oregon Revised Statute 197 (Comprehensive Planning Coordination). The relationships of the alternatives to Land Conservation and Development Commission Statewide Goals are shown in Table 1-5.

LCDC is the primary State agency responsible for implementing the Oregon Coastal Management Program established under P.L. 94-370, the Coastal Zone Management Act (CZMA) of 1972, as amended (16 U.S.C. 1451 et seq.). This program relies initially on county and local comprehensive planning under ORS 197 with special emphasis on unique characteristics of coastal resources. In addition to the 15 statewide goals for planning consideration, coastal planning is guided by four special State Coastal Goals and Guides: Estuarine Resources, Coastal Shoreland, Beaches, and Dunes and Ocean Resources.

CZMA requires Federal activities to be consistent to the maximum extent practicable with the Oregon Coastal program. Although Federal lands are specifically excluded from the coastal zone, such BLM activities as would directly affect coastal resources outside the BLM lands require BLM consistency statements. These statements are made through the A-95 Clearinghouse notification and review process. All alternatives are expected to be consistent with the CZMA. A detailed consistency determination for the preferred alternative is being sent to the Oregon Department of Land Conservation and Development.

The Oregon State Forester, by means of the Forest Practices Act of 1972, regulates timber harvest methods and supportive practices on all non-Federal lands within western Oregon. Minimum standards are prescribed for reforestation of economically suitable lands, road construction and maintenance on forest land, chemical applications, and slash disposal. Although Federal agencies are not bound by State forest practice rules, BLM minimum standards meet or exceed State rules. The BLM and U.S. Forest Service (USFS), acting jointly, have entered into a Memorandum of Understanding with the State Forester in this regard.

The Forestry Program for Oregon (OSDF 1977) outlines basic objectives of the Oregon State Board of Forestry for timberland management within the State. The relationships of the EIS alternatives to these basic objectives are shown in Table 1-6.

Management of wildlife, including fish, is the responsibility of the Oregon Department of Fish and Wildlife (ODFW). BLM, in managing lands under its jurisdiction, considers wildlife habitat as a resource category. The Sikes Act (P.L. 93-452), as amended, is the primary tool guiding coordination between BLM and the ODFW. Cooperative agreements and memorandums of understanding describe the responsibilities of the two agencies.

Section 202(c)(8) of the Federal Land Policy and Management Act requires BLM to provide for compliance with applicable pollution control laws, including State and Federal air and water pollution standards or implementation plans.

In order to comply with the Clean Air Act of 1963 as amended, BLM cooperates in the statewide Smoke Management Plan administered by the Oregon State Forester. The primary objective of the plan is to keep smoke from prescribed fires away from population centers and other smoke-sensitive areas. Slash burning is allowed only when smoke dispersion conditions are determined by Oregon State Department of Forestry (OSDF) to be favorable.

OSDF is the primary contractor for fire protection of public lands administered by BLM in western Oregon. The department undertakes presuppression and suppression actions for all BLM-administered lands in the area and cooperates with BLM's prescribed burning program.

The Oregon Department of Environmental Quality (ODEQ) has lead responsibility for statewide water quality management planning in accordance with the Federal Water Pollution Control Act (Section 208 of P.L. 92-500) as amended by the Clean Water Act (P.L. 95-217). BLM and ODEQ have entered into a Memorandum of Understanding (MOU-OR 158) which outlines their respective roles in

Table 1-5 Relationship of EIS Alternatives to LCDC Statewide Goals [1]

LCDC Statewide Goals	Discussion
Goal 4: To conserve forest land for forest uses.	Under Alternatives 3, 5, 6, 7 and 8, some suitable forest lands could not be reforested due to restrictions on some practices.
Goal 5: To conserve open space and protect natural and scenic resources.	
Land needed or desirable for open space;	None of the alternatives would reduce open space.
Fish and wildlife areas and habitats;	Wildlife populations would increase under Alternative 8. Short-term benefits to some terrestrial animals would occur under all alternatives. Actions under Alternatives 1-7 would reduce wildlife populations and diversity. Fish populations would be slightly reduced under Alternative 2 but would not be significantly impacted under the remaining alternatives.
Ecologically and scientifically significant natural areas;	Vegetation management practices would incorporate features designed to avoid or mitigate impacts on scientifically significant natural areas.
Outstanding scenic views and sites;	Some localized, adverse impacts would affect scenic quality for short periods of time, but overall impacts would be insignificant.
Water areas, wetlands, watersheds and ground water resources;	Water quantity would not be significantly impacted by any alternative. (See Goal 6 for water quality).
Wilderness areas;	Vegetation management practices would be excluded in wilderness study areas pending final designation.
Historic areas, sites, structures and objects;	Historic sites would either be protected or salvaged, if appropriate, under all alternatives.
Cultural areas;	Known archeological sites would either be protected or salvaged, if appropriate, under all alternatives.
Potential and approved recreation trails;	Approved trails would not be directly impacted by any alternative. Some vegetation management practices could be visible from approved trails and could directly impact potential trails.
Potential and approved Federal wild and scenic waterways and State scenic waterways.	Approved waterways would not be directly impacted by any alternative. Some vegetation management practices could be visible from approved waterways and could indirectly impact potential waterways.

Goal 6: To maintain and improve the quality of the air, water and land resources of the State.	
Air Quality	The major pollutants and contaminants affecting air quality would be smoke from slash burns. Slash burning smoke entering Designated Areas would not exceed State or Federal standards under any alternative. Burning would be conducted in accordance with the Oregon Smoke Management Plan, which is the primary State rule for reducing indirect pollution in air quality maintenance areas.
Water Quality	Water quality would or could be affected by sediments and herbicide drift. Neither of these would be expected to cause violation of State or Federal water quality standards.
Land (soils)	Actions undertaken under Alternatives 1-7 would result in some loss of soil productivity. The anticipated losses are considered low.
Goal 7: To protect life and property from natural disasters and hazards.	Design features applicable to all alternatives would protect life and property from hazards. Alternatives 5 through 8 have limitations which would further protect against hazards.
Goal 8: To satisfy the recreation needs of the citizens of the State and visitors.	Developed recreation sites would be protected under all alternatives. Under all alternatives, the short-term adverse visual impacts of vegetation management practices could be visible from some developed sites. Adverse impacts on dispersed recreation users would be localized and short-term.
Goal 9: To diversify and improve the economy of the State.	Total employment would increase under Alternatives 1-7 but would decrease under Alternative 8. Economic diversity would not be affected by any alternative.
Goal 16: To recognize and protect the unique values of estuaries and associated wetlands.	All alternatives could result in some stream sedimentation. Some of these sediments would reach estuaries, but impacts are expected to be minimal.

[1] Public involvement, plan documentation and agency coordination are important aspects of preparing this EIS. Therefore, the EIS alternatives are consistent with LCDC Goals 1 and 2. Other LCDC Goals not generally applicable to the alternatives are: 3. Agricultural Lands; 10. Housing; 11. Public Facilities and Services; 12. Transportation; 14. Urbanization; 15. Willamette Greenway; 17. Coastal Shorelands; 18. Beaches and Dunes; and 19. Ocean Resources. Goal 13, Energy Conservation, was addressed in the western Oregon BLM timber management EISs.

meeting State water quality objectives. The Memorandum assures close interagency cooperation, development and implementation of appropriate practices and control measures to comply with the Clean Water Act and State requirements. BLM vegetation management practices meet or exceed objectives of the statewide water quality management plan.

Permittees and grantees operating within rights-of-way on BLM-administered lands are required to comply with Department of Interior regulations applicable to use of herbicides.

Private Landowners

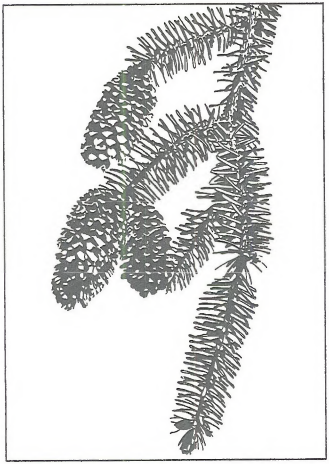
Adjacent private landowners, both timber companies and private residents, are interested in BLM operations near their land. BLM strives to keep these landowners informed about vegetation management operations. Environmental assessments are prepared, and interested landowners are invited to comment on proposed programs. Prior to aerial herbicide operations, all residents and contiguous landowners within one-half mile of spray sites are notified. In addition, copies of spraying plans are posted at public locations in local communities nearest treatment sites.

Table 1-6 Consistency[1] of EIS Alternatives with Basic Objectives of the Forestry Program for Oregon

Basic Objective	Alternatives: Consistent	Minimally Consistent	Inconsistent	Discussion
To maintain the maximum potential commercial forest land base consistent with other resource uses while assuring environmental quality.	1,2,4	5	3,6,7,8	The benchmark (1,892,932 acres) for consistency is the commercial forest land base minus withdrawn TPCC lands. This acreage would be reduced when the available vegetation management treatments could not maintain minimum stocking levels. Environmental quality would be protected to the degree specified in the Oregon Forest Practices Act.
To maintain or increase the allowable annual harvest levels to offset potential socioeconomic impacts.	1,2,4,5	3,6	7,8	The benchmark for consistency is the current allowable cut volume of 1,165 MM bd. ft. per year. The level of cutting the land base can sustain is dependent on number of acres allocated to timber production, level of management the land base receives and productivity of the land.
To identify and implement the levels of intensive forest management and retain the techniques needed to achieve maximum growth and harvest.	1,2,4,5	6	3,7,8	BLM currently implements a full range of vegetation management practices (refer to Vegetation Management Treatments and Design Features, this chapter) for optimizing timber production. New and improved practices would be implemented consistent with technological advances.

[1] Arrived at through consultation with Oregon State Department of Forestry.

Chapter 2 Affected Environment



Sitka spruce

This chapter provides a basis for assessing the impacts of the alternatives. Information is provided commensurate with the importance of impacts, with less important material summarized or simply referenced. More detailed descriptions of the affected environment are presented in the western Oregon BLM timber management EISs (USDI, BLM 1978b, 1979a, 1980a, 1981b, 1983a, 1983b, 1983c).

The primary sources of information used in preparing this chapter were BLM planning system documents developed by the Salem, Eugene, Roseburg, Coos Bay and Medford Districts. The Unit Resource Analysis, Planning Area Analysis and proposed Management Framework Plan (see Glossary) for each district are available for review at the respective district offices. Other references are cited within the text by author and date of publication. A listing of these references appears in the References Cited section.

Climate and Air Quality

The air mass which usually controls weather patterns in the EIS area is predominantly of marine origin. This results in moist, mild winters and dry, moderately warm summers. Average annual precipitation varies from a range of 20 to 50 inches in the interior valleys of southern Oregon to a

range of 60 to 200 inches in the Cascade and coastal mountains of northwestern Oregon.

Because of complex topographic features, considerable microclimatic variability exists within the area. Site-specific climatic information is available in the western Oregon BLM timber management EISs.

The Clean Air Act Amendments of 1970 established three Federal Air Quality Control Regions (AQCRs) in western Oregon. The EIS area is included within the Northwest, Willamette Valley and Southwest Oregon AQCRs. Air quality throughout most of the area within these AQCRs meets Federal standards. Major air quality problems exist in the urban areas of Portland, Salem, Eugene-Springfield and Medford-Ashland (U.S. EPA 1978). For most of western Oregon, however, air quality in 1981 was the best it had been in 6 years (ODEQ 1981).

In 1972, the Oregon State Department of Forestry (OSDF), Federal land management agencies and the Oregon Department of Environmental Quality (ODEQ) developed the Oregon Smoke Management Plan as one means of complying with the Clean Air Act. The Plan is designed to significantly reduce the amount of slash burning smoke carried into or accumulating in certain Designated Areas or other areas sensitive to smoke. These Designated Areas, shown in Figure 2-1, include the Willamette Valley and the cities of Tillamook, Coos Bay, Roseburg, Grants Pass, Medford and Ashland.

The Clean Air Act Amendments of 1977 contain provisions to ensure that air quality does not deteriorate in areas with clean air. Class I areas, allowed virtually no deterioration, are Crater Lake National Park and eight wilderness areas (See Figure 2-1). The remainder of western Oregon is Class II, which allows moderate deterioration of air quality.

Joint Federal and State studies are being conducted to determine whether slash burning in western Oregon impairs visibility within Class I areas. If significant impairment beyond natural levels is indicated, slash burning within the EIS area may be further restricted by modifying current State regulations.

Between 1978 and 1982, BLM in western Oregon burned slash on approximately 450 timber harvest units per year, involving about 13,500 acres annually. This represents about 12 percent of the average number of acres burned annually in the EIS area.

Visible smoke problems have been monitored by the OSDF since 1975. OSDF records for 1981 and 1982 show that approximately 16 percent of the problem burns reported annually resulted from BLM slash burning in western Oregon. These caused or contributed to an estimated five smoke intrusions into Designated Areas each year.

The ODEQ has monitored air quality in western Oregon since 1971 by measuring particulate levels in the atmosphere. Acceptable levels of particulates, established by the U.S. Environmental Protection Agency (EPA), are represented by the National Ambient Air Quality Standards. Primary standards have been established to protect public health and are based on scientific data. Secondary standards have been established to protect the public welfare. The primary and secondary 24-hour concentration standards for total suspended particulates are 260 and 150 micrograms per cubic meter (ug/m^3), respectively (U.S. EPA 1978). Since the adoption of the Oregon Smoke Management Plan, no smoke intrusion from slash burning has exceeded either standard (Personal Communication, Lee Lafferty, OSDF).

A 3-year (1974-1976) study conducted in the Eugene-Springfield area by the EPA concluded that fall slash burning contributed from 3 to 15 ug/m^3 to average 24-hour particulate concentrations, with a maximum contribution of 84 ug/m^3 (U.S. EPA 1978). The study also suggested that fall slash burning may have significantly contributed to levels of fine particulates (smaller than 0.5 microns in diameter).

Geology and Topography

The EIS area includes four physiographic divisions: the Coast Range, Cascade Range, Willamette Valley and Klamath Mountains. These divisions are based upon differing rock types and formations.

Generally, the areas are complexes of volcanics in the Cascades and sediments in the Coast Range. The Klamath Mountains include a complex of volcanic, sedimentary and metamorphic rocks and are the most geologically diverse of the four divisions. More detailed geologic and topographic information is presented in the western Oregon BLM timber management EISs and in Baldwin (1976).

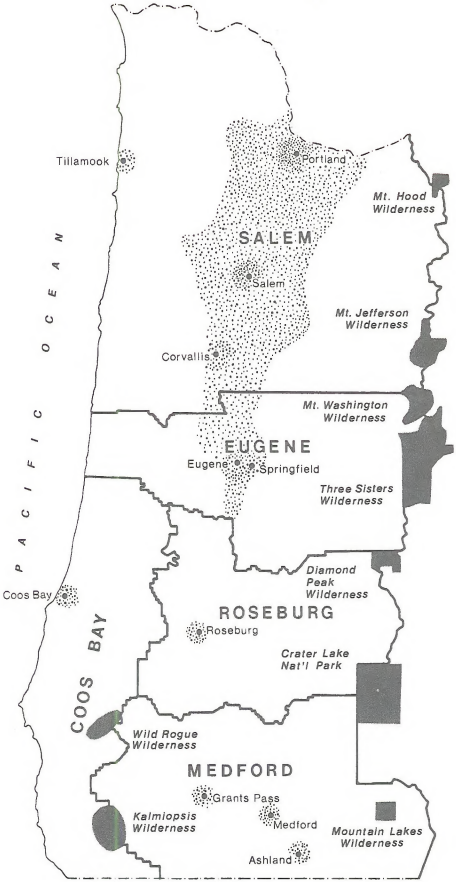


Figure 2-1

Designated and Class I Areas in Western Oregon

Soils

More than 450 soil series have been described for western Oregon. Figure 2-2 shows the distribution of major soil orders within the EIS area. More detailed soil information is available in the western Oregon BLM timber management EISs and BLM and Soil Conservation Service soil surveys.

Soils within the EIS area are generally capable of producing abundant plant growth. Most soils have a high content of organic matter, moderate to high nutrient levels and medium bulk densities. Soils at higher elevations, however, are often low in nitrogen.

Dry ravelling (see Glossary) of soil materials is a natural form of erosion. It occurs mainly on steep slopes (greater than 70 percent) with high gravel content and is accelerated by some vegetation management practices. About one-fourth of the BLM-administered land in the EIS area is highly susceptible to dry ravelling after vegetation cover is removed.

Soils with less than 30 parts per million (ppm) mineralizable nitrogen (see Glossary) are considered highly nitrogen-deficient. Most of these soils are found at high elevations in frigid and cryic soil temperature zones (see Glossary). About 10 percent of the BLM-administered land in the EIS area is in these zones, and a high percentage of this land is nitrogen-deficient. Other nutrient-deficient soils are found in areas where topsoil has been removed through past management activities, in serpentine areas of southwestern Oregon, and in areas where soil organic matter has been depleted by intense fires and has not been replenished by natural processes.

Microorganisms are important components of western Oregon soils. They contribute to decomposition of parent materials, formation and maintenance of soil structure, nutrient cycling and decomposition of organic compounds, including herbicides (Moore and Norris 1974).

Organic matter is the primary food source for soil microorganisms and is a major source of some plant nutrients. It also has a high water holding capacity, promotes good soil structure and reduces erosion. Many organic chemicals, including most herbicides, are quickly adsorbed onto organic matter, reducing their movement through the soil.

Water Resources

Surface water in western Oregon drains to the Pacific Ocean either directly through coastal streams or indirectly through the Willamette, Columbia and Klamath Rivers. Major coastal streams include the Nehalem, Trask, Wilson, Tillamook, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, Coquille, Rogue and Chetco Rivers.

Major tributaries to the Willamette River include the Clackamas, Molalla, Santiam, Calapooya, McKenzie, Middle Fork, Coast Fork, Long Tom, Marys, Luckiamute, Yamhill and Tualatin Rivers. The major tributaries to the Columbia River within the EIS area are the Willamette and Sandy Rivers. Smaller perennial streams are abundant because of high annual precipitation.

The dominant feature affecting the water resources of western Oregon is the mild, moist climate. Most precipitation falls as rain from November to March. Higher elevations usually develop a large snowpack. Winter rainfall is the major source of runoff, with peak flows occurring from December to January and low flows occurring in August. Streams with runoff supplemented by snowmelt may have a secondary peak in May or June.

Surface water is an important resource in western Oregon. Major consumptive uses include municipal, domestic, agricultural and industrial supply. Major non-consumptive uses include fisheries, recreation, aesthetics, hydropower generation, transportation and water quality maintenance. Seventy-four municipal watersheds contain BLM-administered lands in western Oregon. The municipalities, streams and BLM acreages in each of these watersheds are shown in Appendix I.

The quality of surface waters in western Oregon is generally very good, with a dissolved solids content of usually less than 100 milligrams per liter (mg/l). Nutrient concentrations are low, with levels of inorganic nitrogen and phosphorus usually less than one mg/l. Suspended sediment concentrations are usually less than 100 mg/l except during winter storms, when sediments range from 100 to 500 mg/l, and during major floods, when concentrations may exceed 2,000 mg/l. Data on background levels of herbicides in streams is sparse, but available data indicates that herbicides are generally not detectable in streamflow in western Oregon (see Appendix J). According to the limited data available, many large streams in western Oregon have had temperatures

above 64° F, and the Oregon Department of Environmental Quality recommends that temperatures of these streams not be increased (Oregon Department of Environmental Quality 1980; USDI, GS 1981).

Groundwater is widely used in western Oregon, primarily for municipal, domestic and irrigation purposes. Most of the EIS area is underlain by geologic material which yields 1 to 20 gallons of water per minute to wells. The best aquifers are found in alluvial deposits along major streams. This material may yield 20 to 500 gallons per minute. Groundwater quality is generally good in western Oregon, with dissolved solids concentrations less than 500 mg/l.

Vegetation

Terrestrial Vegetation

Widely diverse vegetation communities occur in western Oregon, varying according to climate, moisture, elevation, soils and other environmental factors. These communities present a variety of problems for managing competing vegetation. This section will briefly describe the 10 vegetation zones occurring in western Oregon and their associated vegetation types. More detailed descriptions of these zones can be found in Franklin and Dyrness (1973). General distribution of vegetation zones is shown in Figures 2-3 through 2-5. Proportions of vegetation zones within each western Oregon BLM district are shown in Table 2-1. Over 99 percent of BLM-administered lands in western Oregon fall within the Western Hemlock, Mixed Conifer, Mixed Evergreen and Interior Valley Zones. Acreages in the other six zones are negligible, but vegetation management problems within all zones can be severe.

The Western Hemlock zone is largely dominated by Douglas-fir forests. Within this zone, moist sites favor understory species such as sword-fern, salmonberry and vine maple, while dryer sites favor salal and Oregongrape. Typically, succession of vegetation stages following logging and burning includes an initial herb-dominated stage (e.g., fireweed) followed in a few years by a tall shrub stage (e.g., vine maple, blackberry, ceanothus). This may be followed by a broad-leaved tree stage (e.g., red alder, bigleaf maple). Many competition problems occur when understory vegetation remaining after logging is already in the tall shrub stage.

The Interior Valley Zone is typified by farmlands, oak woodlands, conifer forests, grasslands, evergreen shrubs and riparian communities. Grasslands and forests with mixtures of ponderosa pine, incense cedar, Oregon white oak, California black oak and Pacific madrone are conspicuous. In the Umpqua and Rogue Valleys, evergreen shrubs such as ceanothus and manzanita are common. Regeneration problems can often be severe following timber harvest in this zone, primarily due to moisture limitations caused by grass and brush encroachment.

The Mixed Conifer Zone is located in the eastern Siskiyou Mountains and southwestern Cascades. It ranges from very hot and dry sites bordered by grass or oak woodlands to wetter sites dominated by Douglas-fir and incense-cedar. Regeneration of trees is generally slower than in other zones because of the more severe environment. Brushfields dominated by chaparral-like evergreen shrubs such as manzanita and ceanothus frequently develop, further slowing the rate of forest regeneration.

Table 2-1 Distribution of Vegetation Zones Within BLM Districts

Vegetation Zones	Salem (percent)	Eugene (percent)	Coos Bay (percent)	Roseburg (percent)	Medford (percent)	Western Oregon BLM (percent)
Western Hemlock	98	98	93	47	-	51
Interior Valley	*1	1	-	3	7	4
Mixed Conifer	-	-	-	50	54	30
Mixed Evergreen	-	-	5	-	38	15
Sitka Spruce	1	-	2	-	-	*1
Pacific Silver Fir	*1	*1	-	-	-	*1
Mountain Hemlock	*1	-	-	-	-	*1
White Fir	-	-	-	-	*1	*1
Shasta Red Fir	-	-	-	-	*1	*1
Ponderosa Pine	-	-	-	-	*1	*1

* less than 1 percent

Figure 2-2 Major Soil Orders of Western Oregon

Xeric Soils of Moderate Rainfall Western Oregon Regions

- Mollisols, Alfisols, Vertisols and Ultisols of Valleys
- Alfisols, Ultisols, Inceptisols, Mollisols and Vertisols of Foothills and Mountains

Udic Soils of High Rainfall Western Oregon Regions

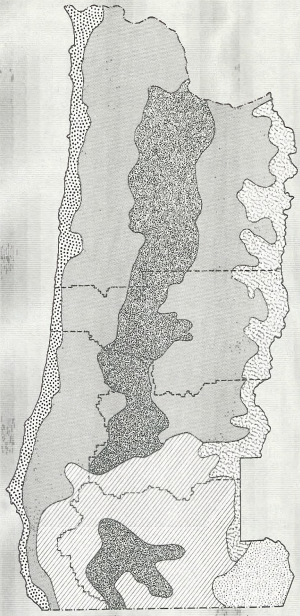
- Spodosols, Inceptisols and Entisols of Valleys and Coastal Lowlands
- Inceptisols and Ultisols of the Coast Range and Western Cascade Mountains
- Inceptisols, Alfisols and Ultisols of the Western Klamath Mountains
- Inceptisols, Spodosols and Entisols of High Mountains

Xeric Soils of Moderate Rainfall Eastern Oregon Forestad Regions

- Mollisols and Inceptisols of the Mountains
- District Boundary

Refer to Appendix H for descriptions of Major Soil Orders

Figure 2-3 Vegetation Zones of Western Oregon



- Sitka Spruce Zone
- Western Hemlock Zone
- Interior Valley Zone
- Mixed Conifer and Mixed Evergreen Zone
- Subalpine Zone
- Ponderosa Pine Zone Interspersed with Mixed Conifer Zone
- District Boundary

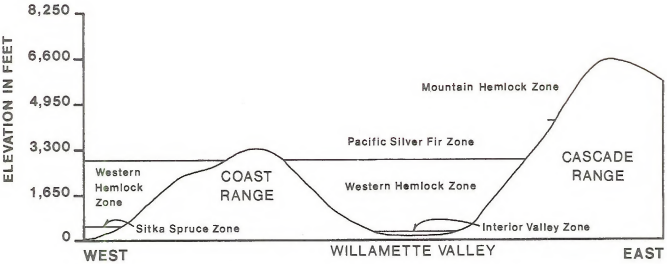


Figure 2-4

Vegetation Zones by Elevation - NW Oregon

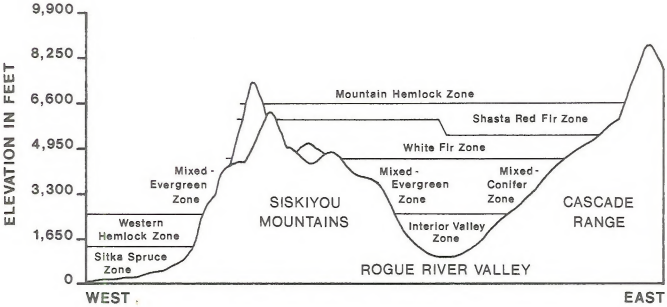
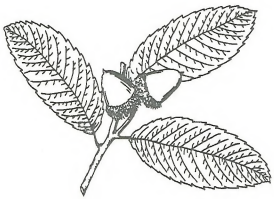


Figure 2-5

Vegetation Zones by Elevation - SW Oregon

Mixed Evergreen Zone forests, found mostly in the western Siskiyou Mountains, consist mainly of Douglas-fir and sclerophyllous species, especially tanoak. Understory communities (low shrub and herb layers) are typically not well developed. Extensive serpentine areas in this zone support a large array of unusual plant species. Succession is often slow, and sites can easily be occupied by evergreen hardwood stands or dense evergreen chaparral. Large areas covered with these brushfields are probably capable of developing forest cover.



Tanoak

Sitka Spruce Zone forests are typically dense, tall and very productive, with lush understories of shrubs, herbs and ferns. Salal and evergreen huckleberry are common. Following logging, dense shrub communities develop quickly in this zone.

The Pacific Silver Fir and Mountain Hemlock Zones occupy higher elevations in the Cascade Range in northern Oregon. Most stands have well developed shrub, herb and moss layers. Understory species becoming dominant after disturbance are generally species that were present in the stands before disturbance, such as huckleberry and beargrass. There is usually less vegetation competition with conifers in this zone.

The White Fir and Shasta Red Fir Zones in southwestern Oregon are characterized by intermingled non-forested brush communities of ceanothus, manzanita and other brush species. These communities are often fire-maintained seral stages occupying sites capable of supporting conifers. Grass dominance is a major problem, particularly when it sustains gopher populations.

The Ponderosa Pine Zone is located in the southeastern portion of the EIS area intermingled with the Mixed Conifer Zone. It is characterized by understories of rabbitbrush and grasses at lower elevations and golden chinkapin, ceanothus and manzanita at middle and upper elevations.

Vegetation competition in the 10 zones within the EIS area varies significantly. For example, on moist sites in northern Oregon, grass may prevent brush encroachment and aid the establishment of conifers, while in southern Oregon, grass deprives conifers of the moisture they need to survive. Succession of brush species into clearcut areas also varies considerably throughout these zones. Such variations require the use of different vegetation management treatments. Plants which moderately or severely compete with conifers in localized areas throughout western Oregon are as follows:

Annual grasses	Red alder	Vine maple
Perennial grasses	Bigleaf maple	Hazel
Blackberry	Cherry	Salmonberry
Willow	Chinkapin	Thimbleberry
Fern	Oak spp.	Manzanita spp.
Ceanothus spp.	Tanoak	Rhododendron
Ocean spray	Madrone	Rabbit-brush
Salal	Ribes spp.	Huckleberry
Snowberry	Elderberry	Scotch broom

Two seral stages are affected by vegetation management practices; the 0- to 7-year-old grass-forb stage and the 8- to 15-year-old brush-seedling stage. These two stages presently account for about 15 percent of the BLM-administered acres in western Oregon. Table 2-2 shows acreages of each stage within the BLM districts.

Riparian habitats are located along lakes, ponds, marshes, rivers and streams. These habitats are transitional between bottomland wetlands and upland terrestrial habitats. They may vary from a few feet wide in steep, first order streams to over 500 feet wide along major rivers. Vegetation is affected by the width of the zone and the amount of water available. In narrow, steep draws,

Chinkapin

Table 2-2 Acreages of Two Early Seral Stages In BLM Districts

	Grass-Forb (0-7 Years)		Brush-Seedling (8-15 Years)		Combined Stages (0-15 Years)	
	Acres [1]	Percent of District	Acres	Percent of District	Acres	Percent of District
Salem	41,400	10	34,700	9	76,100	19
Eugene	34,300	11	30,100	10	64,400	21
Coos Bay	62,010	19	45,692	14	107,702	33
Roseburg	34,100	8	40,900	10	75,000	18
Medford	23,215	3	13,825	2	37,040	5
Total	195,025	8	165,217	7	360,242	15

[1] Includes some acres in regeneration phase with overstory still standing.

vegetation might be restricted to brush species, herbs and sedges, while wider zones may support conifers and large amounts of red alder, western redcedar, bigleaf maple, black cottonwood, Oregon ash or Port-Orford-cedar.

Wetland and Aquatic Vegetation

Wetlands are those areas inundated by surface or groundwater at a frequency sufficient to produce a saturated or seasonally saturated soil condition. Examples of wetlands include marshes, swamps, bogs, wet meadows and natural ponds. Sedges, grasses, rushes, skunk cabbage, cattails and algae are typical wetland and aquatic plants.

Threatened, Endangered or Sensitive Plants

Endangered plants are those species that are in danger of extinction throughout all or a significant portion of their range. Threatened plant species are those that presently are not endangered but are likely to become so within the forseeable future throughout all or a significant portion of their range. Sensitive plants (see Glossary) are those species not yet officially listed, but are undergoing a status review.

At present, one Federally-listed endangered plant species, *Arabis mcdonaldiana,* has been identified in the EIS area. The only recorded sightings of this plant in the EIS area have been within the Siskiyou National Forest. No Federally-listed threatened plant species are known to occur in the EIS area.

Numerous sensitive species observed in the EIS area are currently under review for listing by the U.S. Fish and Wildlife Service as threatened or endangered. The final status of these species will be determined as sufficient data are collected. In the interim, they will be protected from management activities likely to jeopardize their survival on BLM-administered lands. A list of these sensitive species is available upon request.

Animals

Terrestrial Animals

Over 600 species of wildlife, excluding invertebrates, are found within western Oregon BLM districts. The most current list of species can be found in Guenther and Kucera (1978). Site-specific lists are also provided in each BLM district's Unit Resource Analysis (USDI, BLM 1977a, 1977b, 1978c, 1979b, 1980b, 1980c, 1980d).

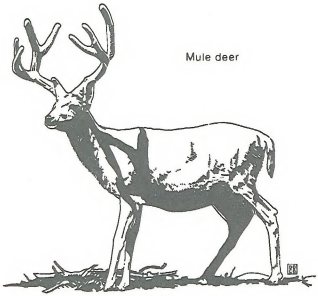
Approximately 40 species of reptiles and amphibians, 88 species of mammals and 216 species of birds are found in the forest environment (Guenther and Kucera 1978). As many as 200 to 300 of these wildlife species might use a single vegetation treatment area.

Habitat needs for all wildlife species include food, water, cover and living space. Various combinations of these components provide a wide range of habitats for different species. Diversity of habitat and associated wildlife species is believed to increase the stability of communities (Thomas 1979).

The occurrence and abundance of wildlife species correspond to broad vegetation zones and to successional (seral) stages (see Chapter 2, Vegetation) and unique habitats within these zones.

The Western Hemlock Zone provides diverse habitat for numerous wildlife species. Its conifer forests are dissected by many streams and/or wet areas which provide riparian corridors and edge

(see Glossary) in an otherwise continuous conifer forest. Old-growth (200+ year) forests of this Zone are very stable communities supporting a wide variety of wildlife. In the Coast Range, deer and elk are particularly abundant, occupying small home ranges with summer and winter ranges in proximity. These animals use dense stands of older forest in this zone for cover and survival forage during harsh weather. At other times, they forage in openings near forest cover. In the Cascades, deer and elk migrate into this zone during the winter to escape deep snow at higher elevations. South-facing slopes below 2,500 feet provide important winter range in the foothills of the Cascades. Cougar and black bear find seclusion and escape cover in the dense forest stands of this zone or in portions of it which are generally inaccessible to people.



The Interior Valley Zone includes wide riparian habitats along the Rogue, Umpqua and Willamette Rivers. Bald eagles and ospreys nest along these rivers. Columbia white-tailed deer occur in bottomlands along the North Umpqua River. Wild turkeys, a recently introduced species, inhabit portions of this zone.

Portions of the Mixed Conifer Zone support large numbers of mule deer and black-tailed deer. Hot, dry conditions of this zone support species similar to those of eastern Oregon, such as the Pacific rattlesnake. The zone's southern edge is used as winter range for the largest migrating black-tailed deer herd in Oregon. Brush typically invades burned or logged areas within this zone, providing forage for wildlife. After an initial growth period, brushfields become dense and decadent, causing forage quality to decline. However, brushfields provide excellent cover for large animals and nesting sites for many birds.

The Mixed Evergreen Zone contains a few wildlife species more closely related to California forms than Rocky Mountain forms, e.g., the ringtailed cat and Siskiyou salamander. Acorns provide food for tree and ground squirrels, wood ducks and some woodpeckers. Shrub species of this zone, such as ceanothus, manzanita, scrub oak and mountain mahogany are preferred browse species for wintering deer.

The Sitka Spruce Zone provides habitat for the greatest number of bald eagles within the EIS area. Large old trees adjacent to estuaries make excellent eagle nest sites. Abundant shrubs and forbs support numerous rodents, particularly mountain beaver. The cool marine climate of this zone makes winter survival difficult for big game, so thermal cover is especially critical.

The Pacific Silver Fir Zone is important summer range for deer and a few elk, but deep snow and cold preclude year-round residency for either species. The zone contains some of the most remote forests in western Oregon and provides habitat for wolverine, fisher, martin and cougar, species that require isolation from people. A few unique species of birds, such as the red crossbill, occur at higher elevations in this zone.

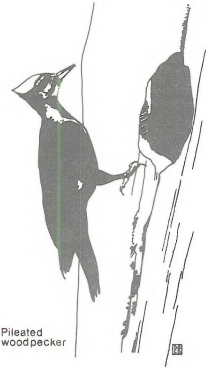
Home ranges of most species are much smaller than the vegetation zones discussed above. Forest seral stages and unique habitats (riparian zones, snags, down material) within these forests more precisely define wildlife habitats.

The 0- to 7-year-old grass-forb and 8- to 15-year-old brush-seedling seral stages are of major importance to many species. According to Meslow and Wight (1975), 86 percent of the bird species found in Douglas-fir forests use the brush-seedling stage, and 39 percent nest in that stage. The feeding and reproduction functions of many small mammals occur primarily in the grass-forb and brush-seedling stages (Thomas et al. 1977). Deer, elk and black bear depend upon early seral stages for food.

Riparian habitat is the most productive of all habitat types for wildlife (Thomas 1979). It provides important edge habitat as it intersects other habitats. Riparian areas also provide travel lanes, migration routes and connector corridors between habitat types. Riparian areas are used by an estimated 260 wildlife species in western Oregon and offer optimum habitat for 50 of these species.

Snags provide nesting sites for numerous species. Ospreys nest in the tops of tall snags adjacent to

large bodies of water. Black-capped chickadees excavate small cavities in very soft snags for nest sites. Pileated woodpeckers excavate cavities in large snags for nesting sites which are later used by some 30 other wildlife species. Flycatchers, bald eagles and other raptors perch on branches of snags while watching for prey. Hairy and downy woodpeckers forage on medium-sized snags for termites and woodborers.



Pileated woodpecker

Down material provides an unusual array of habitats for wildlife. Logs provide escape cover for a variety of animals ranging from small rodents, reptiles and amphibians to deer. Black bears, fishers and skunks make dens in hollow logs. Branches and root wads provide perches for flycatchers and chipmunks. Insects that bore in bark or dead wood are sought out by woodpeckers, reptiles and amphibians. For example, seventy-five percent of the diet of pileated woodpeckers is obtained from insects in down material. The importance of down material to wildlife is described by Thomas (1979).

Threatened or Endangered Animals

Six wildlife species that occur in the EIS area are officially listed by the U.S. Fish and Wildlife Service and/or the State of Oregon as threatened or endangered.

Table 2-3 lists these species, their status and population trends.

The peregrine falcon, a former resident (Gabrielson and Jewett 1970), is occasionally seen in western Oregon. One natural active nest has recently been located (Henry and Nelson 1981). The Columbia white-tailed deer occurs in the oak-ash bottomland and oak-madrone foothills near Roseburg. Bald eagle nesting sites and communal roosting areas are found in large old trees, usually along larger rivers and lakes or adjacent to coastal estuaries. Seven active nests are known to occur

Table 2-3 Threatened or Endangered Species in EIS Area

Species	Federal Status	Oregon Status	Population Trend
Peregrine falcon *Falco peregrinus*	E	E	Declining
Columbia white-tailed deer *Odocoileus virginians leucurus*	E	E	Stable
Northern bald eagle *Haliaeetus leucocephalus alascanus*	T	T	Stable
Northern spotted owl *Strix occidentalis caurina*		T	Declining
Wolverine *Gulo gulo*		T	Declining
Western spotted frog *Rana pretiosa*		T	Declining

T = Threatened E = Endangered

on BLM-administered lands in western Oregon. The northern spotted owl inhabits some of the remaining old growth in the Cascade and Coast Ranges. The wolverine is an extremely wide-ranging species found only in the remote alpine habitat of the upper Cascades. The western spotted frog, once thought to occur throughout western Oregon, has not been observed west of the Cascades for several years.

Fish

Salmon and trout are the principal game fish species inhabiting the streams, ponds and lakes of western Oregon. While habitat conditions have been degraded by past logging activities, road construction, mining, dams and improperly installed culverts, they are now improving as a result of better management practices and regrowth of streamside vegetation. Table 2-4 shows habitat conditions and population trends of salmon and trout inhabiting BLM-administered streams. Numerous ponds, lakes and fish hatcheries which support salmonids are also located on or near BLM-administered lands.

Good quality water of proper temperature, free from excessive amounts of chemical contaminants and sediment, is needed to support and maintain spawning and rearing salmon and trout populations. Silt-free, well-oxygenated gravel is important for salmon and trout spawning and for production of aquatic insects. Well-established riparian zones are needed to maintain high terrestrial insect populations. Since young salmon and trout feed primarily on aquatic and terrestrial insects, abundance of salmonid populations is dependent upon healthy insect populations. Shade provided by riparian zone vegetation maintains water temperatures which are critical for optimum fish production.

Many other species of fish are present in western Oregon. These include introduced game fish such as bass, perch and catfish and nongame species such as sculpins, suckers, dace, squawfish and shiners. Population data for these species are scarce. None are of direct commercial value. Some species may be eaten by trout and salmon and/or compete with them for food and space.

Cultural Resources

Federal agencies have been charged with responsibility for cultural resources (see Glossary) on lands under their jurisdiction. Through a group of laws beginning with the Antiquities Act (1906), BLM has been mandated to identify, protect and enhance such resources on public lands. A number of procedures, including those specified in 36 CFR 800.4(a), were used to identify cultural resources within the BLM districts.

Surveys of existing cultural resource information (Class I inventories) have been completed for each BLM district and are available in the district offices (see Beckham and Minor 1980; Beckham et al. 1981; Honey and Hogg 1980; Minor et al. 1980; Follansbee and Pollock 1978). All recorded sites were identified through a compilation of each district's existing site record data.

The criteria used to assess the eligibility of identified cultural resources for inclusion in the National Register of Historic Places are described in 36 CFR 60.4.

Archeological Sites

Approximately 360 archeological sites have been identified on or near BLM-administered land in the EIS area. Some information has been lost from all of these sites as a result of natural or human disturbances prior to discovery. Future intensive surveys are certain to locate many additional sites.

Table 2-4 Cold Water Fish Habitat and Populations[1]

Species	Stream Miles	Condition of Habitat[2] Exc. (%)	Good (%)	Fair (%)	Poor (%)	Habitat Trend	Current Population	Population Trend
Cutthroat	1,635	10	25	55	10	Stable	Moderate	Stable
Steelhead	766	6	26	58	10	Stable	Moderate	Stable
Chinook	240	3	35	50	12	Stable	Moderate	Increasing[3]
Coho	706	3	21	36	40	Stable	Low	Declining

[1] Habitat miles, condition and trend are for BLM-administered lands only.
[2] Streams in excellent condition have riparian vegetation (see Glossary), abundant and diverse instream structure (see Glossary), numerous high quality pools, sediment-free bottom substrate, adequate spawning gravels and stable banks and channels. Streams in good to poor condition lack one or more of these characteristics.
[3] Due primarily to hatchery releases.

Source: USDI, BLM 1977a, 1977b, 1978c, 1979b, 1980b, 1980c, 1980d.

Most identified archeological sites appear to have been small, seasonally-used campsites. A few larger sites have been found which may have been used as semi-permanent villages. One archeological site is listed on the National Register of Historic Places (see Glossary), and 10 others have been determined eligible for inclusion.

Historic Sites

Approximately 220 historic sites have been located on or near BLM-administered land within the EIS area. Most sites relate to early settlement, transportation, mining and logging. All of these have deteriorated to some extent from weathering and/or human disturbance.

Nine historic sites are listed on the National Register of Historic Places, and another has been determined eligible for inclusion.

Paleontological Sites

Numerous vertebrate, invertebrate and plant fossils are known to occur within the EIS area. These include tree, leaf, mollusc, crustacean, mammoth, bison and horse fossils. Lists and brief descriptions of paleontological sites located on or near BLM-administered lands can be found in USDI, BLM (1981c).

None of the known fossils on BLM-administered land are of remarkable scientific interest. However, all reports of fossil-bearing deposits are examined by qualified personnel to avoid destruction of those which may be important.

Recreation and Visual Resources

Visual resources are the land, water, vegetation, animals and other natural or man-made features visible on public lands. Western Oregon's highways, rivers and trails pass through a variety of characteristic landscapes where natural attractions such as waterfalls and where cultural modifications such as clearcuts can be seen. So that visual resource values can be considered when planning vegetation management activities, public lands have been assigned visual resource management (VRM) classes according to scenic quality, sensitivity level and distance zone criteria (see Glossary). VRM classes provide objectives designed to mitigate adverse impacts of land management practices on scenic values (BLM Manual 8400). VRM maps and narratives derived from inventories and evaluations of visual resources on public lands are available for review in each district office.

Outdoor recreation activities occur throughout the forested environments of western Oregon. Sightseeing, picnicking, camping, fishing and hunting accounted for an estimated 1.8 million visits to public lands during 1982. Other popular activities are driving off-road vehicles, horseback riding, floating rivers and studying natural features. Within the forested environment, each recreational pursuit usually occurs in a particular setting. Fifty-two developed BLM recreation sites provide opportunities for camping, picnicking and swimming. Hunting usually occurs in and around natural or man-made openings such as meadows, clearcuts, logging roads or utility rights-of-way. Dense vegetation and steep terrain generally limit off-road vehicle use on public lands to existing roads and trails. Detailed information on recreational use of public lands is contained in the western Oregon BLM timber management EISs and related background information.

Special Areas

Within the EIS area, BLM administers all or portions of 21 proposed or designated Research Natural Areas, 10 proposed or designated Outstanding Natural Areas, 1 National Wild, Scenic and Recreation River (14 inventoried as potential), 1 National Scenic Trail, 1 National Recreation Trail, 4 State Scenic Waterways, and 43 potential Areas of Critical Environmental Concern (see Glossary). These areas are discussed in the western Oregon BLM timber management EISs.

Wilderness Values

Under the terms of the Federal Land Policy and Management Act of 1976 (FLPMA), roadless areas of 5,000 acres or more with wilderness characteristics are to be reviewed within 15 years

for possible wilderness designation. FLPMA also states that in the event of conflict with or inconsistency between its provisions and those of the O&C Act as they relate to management of timber resources, the O&C Act shall prevail. Accordingly, the wilderness review provisions of FLPMA do not apply to revested Oregon and California Railroad Grant lands and reconveyed Coos Bay Wagon Road Grant lands suitable for sustained yield management as commercial timberlands.

The initial phase of wilderness inventory in the EIS area has been completed, and the Oregon State Director has announced his final decision for public lands included in the intensive wilderness inventory. Three wilderness study areas have been designated in western Oregon. These are Sisters Rock and Zwagg Island in Coos Bay District, and Soda Mountain in Medford District.

Economic Conditions

Vegetation management activities generate employment and personal earnings in the local economy. The level and effectiveness of vegetation management conducted on forest land in western Oregon administered by the Bureau affects the volume of timber which may be offered for sale under the Bureau's policy of nondeclining even flow (see Glossary). Timber harvest yields jobs, personal earnings and public revenue in the local economy. The eighteen counties listed in Table 2-5 are presented here as the regional economy affected by the action. The Bureau administers roughly 2.4 million of the region's 22.1 million acres. This is approximately 10.8 percent of the land base (see Table 1-1).

Description of the Regional Economy

The population of the region increased more than 25 percent between 1970 and 1980 and exceeds 2.3 million (Table 2-5). As part of a nationwide shift of population westward, the rate of growth in the region (2.3 percent compound annual) was more than twice the population growth rate in the United States (1.1 percent). Net migration into the region accounted for 71 percent of the population increase (Seidel 1981). Recent data suggest a turnaround in migration patterns; the region experienced net outmigration from April 1980 to July 1982 (Center for Population Research and Census 1982).

Table 2-5 Population Changes, 1960-1980

County	County Population 1960	1970	1980	Compound Annual Growth Rate (%) 1960-70	1970-80	Net Migration Apr 1980-July 1982
Benton	39,165	53,776	68,211	3.2	2.4	97
Clackamas	113,038	166,088	241,919	3.9	3.8	-84
Columbia	22,379	28,790	35,646	2.6	2.2	3
Coos	54,955	56,515	64,047	0.3	1.3	-3,280
Curry	13,983	13,006	16,992	-0.7	2.7	160
Douglas	68,458	71,743	93,748	0.5	2.7	-3,156
Jackson	73,962	94,533	132,456	2.5	3.4	-807
Josephine	29,917	35,746	58,855	1.8	5.1	-536
Klamath	47,475	50,021	59,117	0.5	1.7	-994
Lane	162,890	215,401	275,226	2.7	2.6	-9,873
Lincoln	24,635	25,755	35,264	0.5	3.2	944
Linn	58,867	71,914	89,495	2.0	2.2	-2,113
Marion	120,888	151,309	204,692	2.3	3.1	-1,438
Multnomah	522,813	554,668	562,640	0.6	0.2	-6,911
Polk	26,523	35,349	45,203	2.9	2.5	-937
Tillamook	18,955	18,034	21,164	-0.5	1.6	-255
Washington	92,237	157,920	245,808	5.5	4.5	6,168
Yamhill	32,478	40,213	55,332	2.2	3.2	129
Region	1,523,618	1,840,781	2,305,815	1.9	2.3	-22,883
Oregon	1,768,687	2,091,533	2,633,105	1.7	2.3	-24,907
United States	179,323,175	203,235,298	226,504,825	1.3	1.1	

Sources: U.S. Dept. of Commerce Census of Population, years indicated; "Components of Change by County," Portland State University, Center for Population Research and Census, 1982.

Employment and income growth in the region's trade and service sectors was strong from 1972-1980 (Table 2-6). This growth was sufficient to absorb a labor force growing because of immigration and an increase in the proportion of women employed or seeking employment. A decline in lumber and wood products employment and a comparatively slow rate of growth in manufacturing employment in the regional economy during the decade are of local concern (C.C.D. Economic Improvement Assoc. 1978, 1979; Coopers and Lybrand 1980; The Fantus Company 1982).

Projections show long-term declines in Oregon lumber and wood products employment (Bruner and Hagenstein 1981). Whether these declines can be offset by continued growth in the nonmanufacturing sector and local programs promoting diversification in non-wood manufacturing is still unknown (C.C.D. Economic Improvement Assoc. 1978, 1979; Coopers and Lybrand 1980; Economic Consultants of Oregon 1981; The Fantus Company 1982).

Because wood products employment averages 35 percent of manufacturing employment in the region, and the sector's output is largely exported to national and international markets, local employment rises and falls markedly with shifts in the national business cycle. To highlight this variability, Figure 2-6 contrasts unemployment rates in the United States, Oregon and two representative counties from the regional economy. The figure shows that Lane and Linn counties' unemployment rates are higher than Oregon's and the national average, and that gap tends to widen during economic recessions. Employment figures for 1981 underscore the effect that the current recession is having on the wood products, construction and reforestation sectors (Table 2-7).

Effects of Vegetation Management Activities on Employment and Earnings

Site preparation, tree planting and treatments designed to insure survival or promote growth of commercial species are activities which generate jobs and personal income in the local economy. In the region, there are roughly 2,000 full-time-equivalent jobs and $20 million in personal earnings in the private sector directly related to reforestation, vegetation management and other forestry services (Table 2-8). In the 1979-81 period, this represented 0.2 percent of the region's total employment and 0.1 percent of total personal earnings.

FIGURE 2-6 ANNUAL AVERAGE UNEMPLOYMENT RATES 1972-1981 (CALENDAR YEARS)

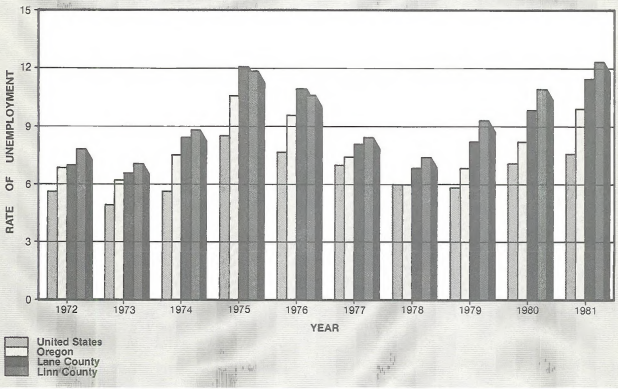
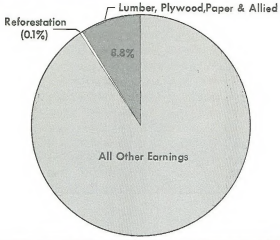


Table 2-6 Average Size and Recent Growth of the Labor Force, Employment and Personal Earnings in the Region

	Regional Economy Average Employment 1979-1981	Regional Economy Compound Annual Growth in Employment 1972-1981 (%)
Civilian Labor Force	1,237,600	3.68
Total Employment	1,123,100	3.70
Nonagricultural Wage and Salary Employment	945,800	3.03
All Manufacturing	201,300	1.93
Lumber and Wood	61,800	-1.64
Paper and Allied	9,300	0.85
All Nonmanufacturing	744,500	4.21
Trade	234,600	4.65
Services & Miscellaneous	173,700	7.24
Federal Government (civilian)	25,300	1.81
State & Local Government	155,100	3.27
Agricultural Wage & Salary Reforestation	1,800	9.95

	Regional Economy Average Personal Earnings 1979-1980 (millions of dollars)	Regional Economy Compound Annual Growth in Personal Earnings 1972-1980 (%)
Labor & Proprietor's Income by Place of Work	16,120.2	10.70
Nonagricultural Personal Income		
All Manufacturing	4,072.9	10.43
Lumber & Wood	1,200.7	6.84
Paper and Allied	212.4	9.25
All Nonmanufacturing	11,964.4	10.81
Trade	6,097.0	10.65
Services & Miscellaneous	2,587.7	12.05
Federal Government (civilian)	460.9	7.04
State & Local Government	1,963.3	9.69
Agricultural Wage & Salary Reforestation	18.4	18.99

Source: Computations by EIS staff of data obtained from Regional Economic Information System, Bureau of Economic Analysis, U.S. Dept. of Commerce; Oregon Covered Employment and Payrolls by Industry and County, Employment Division, Dept. of Human Resources, State of Oregon; Directory of Oregon Manufacturers, Economic Development Division, Office of the Governor, State of Oregon.



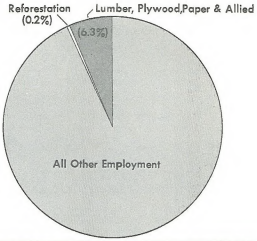


Table 2-7 Changes in Employment in the Regional Economy, December 1979 - December 1981

	Regional Economy	
	Number of Jobs	Percent Change in Employment
Total Employment[1]	+20,800	+1.9
Reforestation	-600	-33.5
All Manufacturing	-33,500	-15.7
Lumber & Wood	-19,500	-29.2
All Nonmanufacturing	-5,800	-0.8
Trade	-1,400	-0.6
Services and Miscellaneous	+16,700	+9.3
Construction	-12,300	-26.4

[1] Includes employment in addition to that listed under it here. For example, employment includes self-employed, agricultural, etc.

Source: Computations by EIS staff of data obtained from the Employment Division, Dept. of Human Resources, State of Oregon.

Table 2-8 Estimated Private Sector Employment in Forestry Services in the Region (1979-1981)

	Annual Average Covered Employment	Annual Average Covered Payrolls	Annual Average No. of Firms	Estimated Total Employment	Estimated Total Earnings
1979	1,978	$18,159,000	172	2,150	$19,738,000
1980	1,847	19,169,000	172	2,019	20,954,000
1981	1,653	18,121,000	186	1,839	20,160,000
Average 1979-1981				2,003	$20,284,000

Source: Data on covered employment and payrolls (see Glossary) are from Employment Division, Dept. of Human Resources, State of Oregon.

Table 2-9 reports that an average of 84,000 acres of BLM-administered land are treated in the region each year, and an estimated 39,800 days of work in the private sector are directly dependent on this level of annual treatment. Together, this employment yields personal earnings of approximately $1.6 million.

Effects of Timber Harvest on Employment and Earnings

The sale of timber from lands administered by the Bureau in western Oregon is governed by the principle of sustained yield. Through time, the volume offered may increase as reforestation success improves, where foresters can maintain optimum spacing among crop trees and when the distribution of timber ages becomes balanced. The level and effectiveness of vegetation management accomplished by the Bureau affects the volume of timber offered for sale by influencing the speed of reforestation and rate of growth in young stands.

Timber-related industries play a large role in the region's economy. Approximately 1 of every 16 workers in the region harvests, processes or transports some type of wood product (ratio of lumber, wood, paper and allied employment to total employment, Table 2-6). In contrast, 1 of every 52 workers in the United States was involved in forest management, harvesting, primary processing or transportation and marketing of wood products (1972 estimate derived from Table A-43, Phelps 1980).

Timberlands administered by the Bureau in western Oregon play a significant role in providing raw material to the region's lumber and wood products sector. In fiscal years 1979-1981, an annual average of 943.9 million board feet (MMBF) was harvested from land administered by the Bureau's five western Oregon districts (Table 2-10). For these years, this represented 14.5 percent of the region's average annual harvest from all ownerships (Table 2-11). From 1979-81, harvest and conversion of BLM timber into lumber, plywood, paper and allied products supported an average of 5,900 direct jobs and $102.5 million in payroll in the region (Table 2-12).

Since counties and some local jurisdictions in the region share receipts from the harvest of BLM timber with the Federal government, fluctuations in timber harvest on lands administered by the BLM in western Oregon also affect employment in county and local government. Disbursements to county and local governments during 1979-1981 are estimated to have directly funded just less than 1,900 jobs and $27 million in payroll each year.

The effects of the Bureau's vegetation management, timber management and public revenue sharing on employment and earnings are summed in Table 2-12.

Table 2-9 Average Levels of Reforestation and Vegetation Management Activity on BLM Land in Western Oregon and the Private Sector Employment Generated (FY 1979-82)

Activity	Acres Avg. FY 79-82	Direct Employment (average days of employment per year)
Site Preparation		
Mechanical		
Scarification	2,068	1,034
Piling	2,699	5,398
Gross Yarding	10,981	4,392
Hydro-axe	9	2
Manual		
Cutting	488	244
Spot Clearing/ Scalping	149	199
Slash/burn	49	18
Chemical		
Aerial	6,000	214
Ground	372	186
Burning	11,582	2,316
Tree Planting	27,120	25,828
Maintenance and Release		
Manual		
Cutting	453	906
Mulching	162	216
Pulling	36	18
Chemical		
Aerial	10,835	387
Ground	1,274	1,274
Biological		
Seeding	0	0
Animals	34	17
Precommercial Thinning		
Manual	6,719	6,719
Chemical	0	0
Roadside Maintenance		
Mechanical	2,217	NA
Manual	332	332
Chemical	187	NA
Weed Control		
Mechanical	55	NA
Manual	0	0
Chemical	105	NA
Summary of Major Groupings		
Gross Yarding Employment[1]		4,392 (20 FTE[2])
Tree Planting (Reforestation) Employment		25,828 (117 FTE)
Control of Competing Veg. Employment		9,613 (44 FTE)
Total		39,833 (181 FTE)

[1] Included in timber harvest and processing employment (see Table 2-12).
[2] Each full-time-equivalent (FTE) work year equals 220 work days.

Source: Acres are from annual "Program and Cost Report," USDI, BLM. Contract-employment is based on production rates and overhead factors estimated by BLM silviculturists.

Effects of Timber Harvest on Public Revenue

Receipts from the sale or use of resources found on O&C, Coos Bay Wagon Road (CBWR) and public domain lands are distributed to State and local governments through formulas established by Congress and the Oregon legislature. Receipts from the sale of timber on all O&C lands are pooled. Fifty percent of this revenue is distributed among the counties with O&C land in proportion to the 1915 assessed value of the O&C lands in each county. Payments made to local governments from CBWR land revenues are calculated in the form of timber severance and in-lieu property taxes. Four percent of revenues from public domain lands is remitted to State governments. In Oregon, these revenues are distributed to counties on the basis of total land area for the benefit of county roads and bridges.

Table 2-13 reports recent disbursements to the State of Oregon, counties and other local governments within the region generated by timber harvest on BLM land and distributed according to the formulas cited above. Since O&C revenue distributions represent 99 percent of the total BLM timber-related disbursements displayed in Table 2-13, O&C disbursements are the only forms of public revenue discussed in the balance of this EIS. Table 2-14 details these O&C distributions by county. Table 2-15 indicates that in fiscal 1977-78, O&C disbursements were 24 percent of total county revenues in the eighteen-county region. This includes revenues from O&C land administered by the U.S. Forest Service and nontimber sales and leases on land administered by the BLM. Per resident, county receipts of O&C revenue distributions ranged from $317 in Douglas County to $2 in Multnomah County.

Table 2-16 shows the effect of O&C revenue distribution on the counties in two ways. Shown in the left column is the additional amount of tax per $1,000 of assessed value each county would have to levy to generate an amount of revenue equal to the O&C distribution. Alternately, the right-hand columns show O&C revenue distributions as percentages of the total amount levied by each county assessor. For example, in 1978 the distribution to Douglas County was 110.3 percent of the total amount levied by taxing districts within the county.

Table 2-10 Harvests, Sales and Receipts from BLM Timber in the Region (1979-1982)

Fiscal Year	Sales (MMBF)	Harvests (MMBF)	Value of Sales ($1,000,000)	Value of Receipts ($1,000,000)
1979	1,096.8	1,045.2	302.6	183.3
1980	1,120.6	929.3	365.7	181.9
1981	1,059.1	857.3	282.6	184.6
1982	1,112.8	345.9	105.6	61.8
Annual Average 1979-1981	1,092.2	943.9	317.0	183.3

Average Value per M bd. ft. sold (1981): $267
Average Value per M bd. ft. sold (1982): $ 95

Source: BLM Facts-Oregon and Washington, various years, and other BLM files.

Table 2-11 Average Timber Volume Harvested Annually (1978-1981) in the Region (Millions of Board-feet, Scribner Long Log Scale) [1]

Calendar Year	BLM	All Ownerships
1978	830	6,365
1979	943	6,246
1980	793	5,288
1981	676	4,472
Avg. 78-81	811	5,593

[1] BLM totals differ between Tables 2-10 and 2-11. Data for Table 2-10 are available only for fiscal years (Oct. 1-Sept. 30), and log volume is measured by Scribner short-log rules. Data for Table 2-11 are tabulated by calendar year, and log volume is measured by Scribner long-log rules.

Source: Oregon State Department of Forestry, "Oregon Timber Harvest Report," various years.

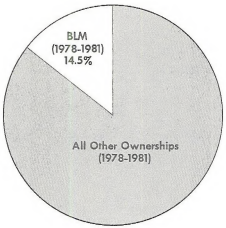


Table 2-12 Estimated Annual Effects, on Private Sector Employment and Earnings, of Forest Management Practices on Lands Administered by BLM in Western Oregon (1979-1981)

	Jobs [1]	Regional Economy Payroll (Millions of dollars)
Reforestation (27,100 acres planted)	117	1.2
Control of Competing Vegetation (45,900 acres treated)	44	0.4
Timber Harvest and Processing [2] (911 MMBF [3])	5,900	102.5
Public Revenue Disbursement ($82.98 million)	1,900	26.8
Economic Effect on Other Business Sectors [4]	13,039	204.1
Total Economic Effect in Region	21,000	335.0

[1] All estimates refer to full-time equivalence, e.g., two jobs of 6-month duration are the equivalent of one full-time job.
[2] Includes gross yarding.
[3] 811 MM bd. ft. long log Scribner divided by 0.89, a factor which converts long log to short log Scribner measure.
[4] Based on employment and personal income multipliers derived using the USFS input-output model, IMPLAN (see Glossary) (analysis prepared by EIS staff).

Source: Computations by EIS staff.

Table 2-13 Payments to Counties in the Region (1979-1982) Resulting From Timber Harvest on BLM Lands (thousands of dollars)

Fiscal Year	O&C	CBWR	PD
1979	82,370	602	122
1980	83,080	522	112
1981	83,500	850	151
1982	33,840	568	53
Avg. 1979-81	82,980	658	128

Source: Payments for timber received by BLM's five western Oregon districts. The accounting section in each district records payments by land status.

Table 2-14 O&C Disbursements Contributed by BLM Timber Harvests

County	Percent Share of O&C Payment	Annual Payments (millions of dollars) FY1979	FY1980	FY1981	FY1982	Avg. 79-81
Benton	2.81	2.31	2.33	2.35	0.95	2.33
Clackamas	5.55	4.57	4.61	4.63	1.88	4.61
Columbia	2.06	1.70	1.71	1.72	0.70	1.71
Coos	5.90	4.86	4.90	4.93	2.00	4.90
Curry	3.65	3.01	3.03	3.05	1.24	3.03
Douglas	25.05	20.63	20.81	20.92	8.48	20.79
Jackson	15.67	12.91	13.02	13.08	5.30	13.00
Josephine	12.08	9.95	10.04	10.09	4.09	10.02
Klamath	2.34	1.93	1.94	1.95	0.79	1.94
Lane	15.27	12.58	12.69	12.75	5.17	12.67
Lincoln	0.36	0.30	0.30	0.30	0.12	0.30
Linn	2.64	2.17	2.19	2.20	0.89	2.19
Marion	1.46	1.20	1.21	1.22	0.49	1.21
Multnomah	1.09	0.90	0.91	0.91	0.37	0.90
Polk	2.16	1.78	1.79	1.80	0.73	1.79
Tillamook	0.56	0.46	0.47	0.47	0.19	0.46
Washington	0.63	0.52	0.52	0.53	0.21	0.52
Yamhill	0.72	0.59	0.60	0.60	0.24	0.60
		82.37	83.08	83.50	33.84	82.98
Total O&C Disbursements		96.77	97.61	96.96	39.30	
Percent of O&C Collections which are from BLM Lands		85.8	85.8	86.9	86.9	
Percent of BLM (O&C) Collections Derived from Timber Sales		99.2	99.2	99.1	99.1	

Source: BLM Facts-Oregon and Washington, various years, reports payments to counties. Data displayed in those documents provide the basis for the above calculations.

Table 2-15 Distribution of O&C Receipts to O&C Counties FY 1981-1982

O&C County	County Revenues From All Sources (thousands of dollars)	O&C Disbursement (thousands of dollars)	O&C Disbursement As Percent of Total	O&C Disbursement Per Capita
Benton	$13,512	$ 2,724	20.2	$ 38.89
Clackamas	46,280	5,381	11.6	21.95
Columbia	7,349	1,997	27.2	55.25
Coos	15,281	5,720	37.3	90.37
Curry	12,201	3,539	29.0	203.38
Douglas	49,693	24,287	48.9	263.14
Jackson	33,913	15,193	44.8	113.63
Josephine	20,916	11,712	56.0	191.38
Klamath	18,955	2,269	12.0	38.70
Lane	74,671	14,805	19.8	54.70
Lincoln	13,147	349	2.7	9.82
Linn	19,378	2,560	13.2	28.28
Marion	32,919	1,416	4.3	6.75
Multnomah	127,728	1,057	0.8	1.87
Polk	8,436	2,094	24.8	44.89
Tillamook	10,123	543	5.4	25.73
Washington	61,510	611	1.0	2.41
Yamhill	8,387	698	8.3	12.40
All 18 O&C Counties	$574,399	$96,955	16.7	$ 41.22

Source: Bureau of Governmental Research & Service, University of Oregon 1983.

Table 2-16 O&C Revenue Distribution to Counties Expressed as Property Tax Rate Equivalent and as Percent Supplement to Total Levy, Fiscal Years 1978-1981

	Amount per $1,000 Assessed Value [1]				Percent Supplement to Levy [2]			
County	1978	1979	1980	1981	1978	1979	1980	1981
Benton	$ 2.26	$ 2.03	$ 2.05	$ 1.94	12.3	12.4	10.5	8.2
Clackamas	1.17	1.01	0.90	0.79	5.4	5.5	4.6	3.5
Columbia	1.77	1.86	1.86	1.58	12.7	13.0	11.7	10.4
Coos	5.32	4.81	4.59	4.17	31.9	29.0	25.3	19.8
Curry	9.81	8.38	7.09	6.71	102.1	92.9	109.2	67.2
Douglas	12.44	11.59	11.50	10.56	110.3	103.8	79.5	67.9
Jackson	6.90	5.85	5.51	5.07	39.3	41.2	33.0	27.2
Josephine	11.78	10.04	9.56	8.58	74.4	89.8	63.0	61.4
Klamath	1.85	1.73	1.68	1.53	13.4	13.7	11.7	10.9
Lane	2.91	2.48	2.36	2.22	14.1	13.6	11.6	10.3
Lincoln	0.40	0.33	0.31	0.27	2.5	2.2	1.6	1.8
Linn	1.39	1.37	1.30	1.26	8.2	8.5	7.1	6.2
Marion	0.43	0.39	0.36	0.33	2.0	2.0	1.7	1.5
Multnomah	0.09	0.08	0.08	0.07	0.4	0.4	0.4	0.3
Polk	2.75	2.43	2.41	2.22	13.6	13.1	12.2	9.9
Tillamook	1.14	1.03	0.93	0.83	7.7	6.4	8.7	5.7
Washington	0.13	0.11	0.10	0.09	0.6	0.6	0.5	0.3
Yamhill	0.75	0.67	0.64	0.50	3.7	3.6	3.1	2.7
Average	2.19	2.54	1.81	1.67	10.9	10.9	9.5	7.8

[1] Represents county O&C distribution for fiscal year (ending September 30) divided by total assessed value (in thousands) on January 1 of same calendar year.
[2] Represents O&C distribution as percent of total property tax levy for following year, e.g., FY 1977 distribution as percent of 1977-78 levy.

Source: BLM Facts-Oregon and Washington, various years; Oregon Dept. of Revenue, Oregon Property Tax Statistics, various years.

Social Environment

The social environment affected by BLM's vegetation management program includes individuals and the communities, organizations, and groups they have formed, their agencies and institutions of government, and the companies and businesses they work for. It also includes people's attitudes, opinions and perceptions about vegetation management policies and practices. A detailed social analysis of the EIS area including a population profile and demographic analysis, an institutional analysis and a formal public opinion survey was not undertaken for this EIS. However, during the past 5 years BLM has conducted studies in the area, with extensive public involvement, for seven timber management EISs, a vegetation management EIS and numerous environmental assessments. The following description of the social environment that could be affected by BLM's vegetation management program is based on that information and on concerns expressed during the scoping meetings for this EIS.

Social Dimensions of Employment

In addition to direct impacts on people's jobs and personal income, there are social aspects of employment that may be affected by BLM's programs. These social aspects include the importance of certain types of jobs to specific communities, people's degree of dependence on particular jobs, the availability of alternative jobs, people's access to jobs, and a community's level of acceptance of certain types of work. For example, some people are very dependent on a certain type of work; for some people alternative jobs are not available, access to alternative jobs is limited, or alternative jobs are perceived as inappropriate work. The social effects of job losses are more significant for these people than for those who are flexible and have access to alternative jobs.

The extent to which the social environment may be affected by economic impacts can be estimated in terms of the numbers of jobs in western Oregon that are dependent on the timber harvest from, reforestation of, and vegetation management on BLM lands. Based on information in Chapter 2, Economic Conditions (see Tables 2-6 and 2-11) BLM-administered lands can be roughly estimated to provide the resource base for approximately 10,310 forest products jobs (14.5 percent of forest products employment in the region), and about 261 reforestation and vegetation management jobs (14.5 percent of all reforestation and vegetation management jobs in the region). These estimates are based on the fact that approximately 14.5 percent of the region's timber harvest is from BLM lands. The forest products jobs are about 0.9 percent of the total employment in the region, and the reforestation jobs are about 0.02 percent of the total.

Another significant social dimension of employment is the distinction between timber harvesting and processing jobs and reforestation and vegetation management jobs. Loggers and mill workers are paid more than reforestation and vegetation management workers. In addition, the attitudes and cultural identities of the workers are often different. Therefore, available jobs in one category cannot be easily substituted for lost jobs in the other.

Public Services

The public services potentially affected by BLM's vegetation management program are those provided by the 18 counties in western Oregon which receive revenue from O&C timber sale receipts. Services provided by the counties include public safety, tax assessments, road maintenance, courts, health and human welfare, maintenance of land records and others. O&C revenues are paid into each county's general treasury and are not allocated by BLM to specific services. Table 2-15 shows the importance of the O&C receipts to each county budget, and Table 2-16 shows the O&C revenues expressed as property tax rate equivalents for the 18 counties over the fiscal years 1978 through 1981.

Attitudes and Opinions

A significant social issue related to BLM's vegetation management program is public disagreement about the use of chemical herbicides and the effectiveness of alternative treatments. A clear illustration of this phenomenon can be seen in the letters of comment on BLM's 1978 Draft EIS *Vegetation Management with Herbicides: Western Oregon - 1978 through 1987*. There, in reviewing the same document, opponents of herbicide use perceived a bias in favor of using herbicides while proponents of herbicide use perceived a bias against using herbicides. The opponents see BLM as an advocate of herbicide use, defending that position rather than seeking public input to the process of decisionmaking. The proponents see BLM abandoning what they believe to be a demonstrably safe and effective means for increasing timber production.

The controversy has opposing factions whose points of view are sometimes unaffected by the other side's perceptions or data. BLM is in the middle, having to make decisions that best serve a larger public interest encompassing much more than this controversy. The full extent and intensity of the controversy among the people of western Oregon is not known.

The controversy is sustained by the following four factors. First, EPA has approved the chemicals for use and has provided instructions for safe handling and application. For some people this is the whole story. They see no basis for opposition to using the herbicides and, therefore, no reason for BLM to limit herbicide use or to entertain alternative points of view. A related factor is the observation that the same herbicides used in forestry are used more frequently and in larger amounts for agriculture and home use, without generating comparable opposition.

Another factor is that some people are suspicious of the accuracy of EPA's determinations about herbicides. They fear that the approved herbicides may eventually be found to be as dangerous as other substances previously thought to be harmless. By then, they reason, it will already be too late to avert at least some harmful consequences.

A third factor which sustains the controversy is the difficulty in establishing scientifically, in a way that is comprehensible and believable to concerned individuals and interest groups, either the presence or the absence of cause and effect relationships between herbicide use and environmental damage or between exposure to herbicides and human health problems. This complicated scientific situation is important in three ways. In some cases (especially concerning long-term effects) the scientific evidence may simply be inconclusive. Therefore, questions concerning the effects of using a particular chemical, though they appear to be scientific questions, may have to be answered today in social and political terms. Conclusive scientific analyses may not be available for years. Secondly, some segments of the public may distrust or reject sound scientific conclusions because they cannot understand the analytical process leading to the conclusions and/or because they have come to consider all scientific studies concerning herbicides to be inconclusive or dubious. Finally, some people criticize the fact that many studies of the health effects of herbicides are based on laboratory animal studies, while their direct experiences of perceived impacts on people and wild and domestic animals seem to be ignored. A more extreme manifestation of this problem arises when parties to the controversy do not even agree on the identification of credible sources of information and analysis or on the definition of legitimate scientific research.

A fourth factor that helps sustain the controversy about herbicide use is that some people are increasingly concerned about not having control over their larger environment, including the management of public land resources. There is a growing sense that the non-professional public has a legitimate interest in how the public land resources are managed. A traditional attitude of "leaving resource management to the professionals" is becoming less prevalent, and increasing numbers of people seem to have a desire to have some say in how the professionals (in this case BLM foresters and managers) do their job.

Another controversial vegetation management issue is smoke from burning. Concern with smoke is greatest in the Eugene and Medford metropolitan areas. Smoke has not been identified as a significant issue in other areas.

Just as there are social factors linked to economic conditions, there are social factors linked to other components of the environment such as air and water quality, wildlife and recreation, and linked to human health and public safety issues. For example, some people are concerned about the safety of forest workers and the health of others who are exposed directly or indirectly to the chemicals, with or without awareness of the exposure. Some people are also concerned about contamination of water sources that are eventually used for such things as irrigation, stock watering, domestic water supply and fish hatcheries. The persistence of these fears and anxieties appears to be directly related to the perception of scientific uncertainty about the existence of health risks.

Community Stability

Approximately 2,265,000 people (about 86 percent of Oregon's population) live in western Oregon, with nearly 606,000 (about 27 percent of western Oregon's population) in the central cities of Portland, Eugene, Springfield and Salem, and roughly the same number in smaller cities and suburbs surrounding the large cities. Therefore, about half the population of western Oregon lives in small communities and rural areas. The residents of the larger metropolitan areas use forest products and are the majority of forest recreation users. Some of them are concerned about forest management practices and their impacts on environmental quality.

In rural areas, different communities and different groups within some communities may have incompatible wants, needs and uses for BLM-managed forest lands in western Oregon. The proximity of small communities and rural residences to forest lands affects people's attitudes about lifestyle, quality of life and their sense of individual and group identity. Some small communities are largely dependent on forest industry employment, and forest lands are also preferred locations for a variety of recreational and

subsistence activities. There are also an increasing number of people living in the forested regions who value forest lands primarily for reasons other than timber production.

The people who are most likely to be affected, sometime, by the BLM vegetation management program are those who live in close proximity to BLM lands. During the years 1977 to 1979, the BLM district offices in western Oregon inventoried residences within one-half mile of BLM-administered lands. The results of those inventories were:

District Office	Residences
Salem	2,307
Eugene	2,945
Roseburg	3,400
Medford	5,600
Coos Bay	1,503
Total	15,755

Changes have, of course, occurred during the succeeding years, and the numbers of inhabitants of each residence are not known. However, these figures provide a reasonable estimate of the numbers of residences in areas most likely to be directly affected by BLM's vegetation management activities.

Chapter 3 Environmental Consequences

Douglas fir

In this chapter, environmental consequences (impacts) are compared to the exisiting situation, as described in Chapter 2. The significant impacts resulting from implementation of each of the alternatives are analyzed in relation to these baselines. A tabular comparison of composite impacts from each alternative is shown in Table 1-4. Analysis, including the scoping process, indicates that the proposed program for managing competing vegetation would have no significant impacts upon climate, geology, topography, minerals, grazing, agriculture, utilities, communications sites, paleontological sites, energy, wilderness, wetlands and aquatic vegetation. Therefore, these topics are not discussed. Vegetation management practices would increase coniferous wood fiber production and provide for higher timber harvests in the short and long term, but would diminish long-term productivity for some plant and animal species. No irreversible or irretrievable commitments of resources would be involved in implementing the proposed program.

The major actions which cause impacts are site preparation, plantation maintenance and release, precommercial thinning, roadside maintenance and weed control. Most of these impacts would occur on lands within the 0-7- and 8-15-year seral stages as shown in Table 2-2. Approximately 15 percent of BLM-administered lands are expected

to be within these seral stages during the next decade.

Basic assumptions of the analysis are that sufficient funding and personnel will be available for implementation of the final decision, all design features described in Chapter 1 and Appendices D and E will be applied, and types and amounts of treatments will be applied as indicated in Table 1-2. The program is intended to be in effect for approximately 5 to 10 years.

Impacts on Air Quality

The major impacts on air quality in the EIS area would be increases in particulates and visible smoke from slash burning. Air quality would not be significantly impacted under any alternative, although minor increases in particulates and visible smoke from slash burning would occur.

Compared to burning done by BLM each year for the past 3 years, acres burned would increase under all alternatives except 3 and 8 (see Table 1-2) as a result of stronger management commitment, greater success in accomplishing burns and increased harvest of second-growth timber. Based upon past experience, these increases in burning would not be expected to exceed the 150 ug/m^3 National Ambient Air Quality particulate concentration standard under any alternative (see Chapter 2, Air Quality).

In addition to particulates, combustion of forest residue produces water vapor, carbon dioxide (CO_2), carbon monoxide (CO), sulfur oxides (SOx), nitrous oxides (NOx) and hydrocarbons (HC) (Sandberg et al. 1979). Table 3-1 shows estimated quantities of these emission components which would be produced under each alternative.

Emission component levels can be reduced as much as 50 percent by gross yarding and removing fuels from sites, and by burning under spring-like conditions when heavy fuels are moist but light fuels are dry. Gross yarding and removing fuels has been reported to reduce particulate emissions by 200 to 2,000 pounds per acre depending on the size of fuels removed and the season of burning (Sandberg and Ward 1982). Aggressive actions to extinguish slash burns would also reduce smoke. Particulate emissions from BLM slash burns would be highest under Alternative 6 and would be eliminated under Alternative 3.

Regardless of the alternative selected, all burning would be done in accordance with the Oregon Smoke Management Plan and site-specific prescribed fire plans. The Oregon Smoke Management Plan would limit the number of prescribed burns per day and amount of slash consumed upwind of Designated Areas to protect population centers from smoke. Normally, smoke would be carried into upper air levels and away

Table 3-1 Average Emission Components From Slash Burning (Tons/Year)

	Existing Situation	Alt. 1 (PA)	Alt. 2 (Max. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Tons of Slash Burned[1]	336,650	500,025	473,775	0	497,025	502,150	508,400	489,150	418,275
Water Vapor and Carbon Dioxide[2]	Greater than 90% of the mass of combustion products								
Contaminants									
Particulates[3]	7,070	10,500	9,949	0	10,438	10,545	10,676	10,272	8,784
Hydrocarbons[4]	4,208	6,250	5,922	0	6,213	6,277	6,355	6,114	5,228
Carbon Monoxide[5]	43,765	65,003	61,591	0	64,613	65,280	66,092	63,590	54,376
Sulfur Oxides[6]	Negligible								
Nitrous Oxides[7]	673	1,000	948	0	994	1,004	1,017	978	837
Total Contaminants	55,716	82,753	78,410	0	82,258	83,106	84,140	80,954	69,225

[1] Based upon 24 tons per acre.
[2] Average emission is 1 to 1½ tons/ton fuel burned (Ryan et al. 1976 Cited in Sandberg et al. 1978).
[3] Particulates are near 0.1 micrometer in diameter. Average emission is 17 to 67 pounds/ton fuel burned. To put the particulate levels presented here into perspective, wood burning stoves and fireplaces produced 8,500 tons of particulates in Portland, 1,900 tons in Medford, and 2,300 tons in Eugene during 1981.
[4] Hydrocarbons are a diverse class of compounds containing hydrogen, carbon and oxygen. Average emission is 25 pounds/ton fuel burned.
[5] Average emission is 20 to 500 pounds/ton fuel burned. Carbon monoxide is unstable and dissipates rapidly in the atmosphere.
[6] Sulfur oxides (SOx) are produced in small quantities, since most forest residues contain less than 0.2 percent sulfur.
[7] Nitrous oxides (NOx) are only found in some very hot fires. The temperature required to fix atmospheric nitrogen is over 2,800° F, and these temperatures are not easily attained in slash burns. Average emission is 4 pounds/ton fuel burned.

Sources: Hall (1972), Sandberg et al. (1978) and U.S. EPA (1978).

from Designated and Class I Areas (see Figure 2-1). Occasionally, however, unforecasted weather changes could cause smoke to reach these locations. Past experience indicates that visible intrusions into Designated Areas would occur. Since smoke particles can scatter visible light for up to 100 miles downwind from a burn, visible intrusions could also occur into Class I Areas (Personal communication, John Deeming, USFS PNW Forest and Range Experiment Station, Portland). The probability of visible intrusion into Designated and Class I Areas would be highest under Alternative 6, due to more acres burned, and would be eliminated entirely under Alternative 3.

Emissions are also produced by burning gasoline and diesel oil used for fuel ignition. Since gasoline and diesel oil have chemical compositions similar to that of forest residue, their combustion produces similar emissions. During slash burning, approximately 1 gallon of gasoline-diesel oil mixture is applied per acre by hand-held drip torches, or 2 gallons of gasoline per acre are applied by helicopter-carried drip torches. Data on the quantities of emissions produced by burning gasoline and diesel oil during slash burning are currently unavailable. The small amounts used, however, suggest that emissions produced would not impact air quality significantly.

Impacts from the combustion of gelled gasoline would be insignificant. The final combustion products of the gelling additive are aluminum oxide, water and carbon dioxide. It is expected that the small quantities of aluminum oxide produced would be consumed in the fire (Personal communication, John Kowalczyk, ODEQ).

Impacts on Soils

The major impacts of vegetation management on soils are compaction, topsoil removal, dry ravelling and depletion of organic matter and nitrogen. These impacts are caused primarily by scarification and/or slash burning. Other vegetation management practices do not significantly impact soils. To minimize adverse impacts on soils, slash burning and scarification would be avoided, where feasible, on thin, droughty (see Glossary) or nitrogen-deficient soils.

Scarification and piling would result in soil compaction and loss of nutrients through topsoil removal. Clutter and Dell (1978) have shown scarification reduced soil productivity (see Glossary) by 11 to 22 percent in 30-year-old pine plantations. Power (1981a) has measured a 17 percent reduction in productivity in an 18-year-old Douglas-fir stand. Longer-term data on the impacts of scarification are not available. Impacts would generally be greater on shallow soils and soils in the frigid and cryic temperature zones.

Scarification and piling would be expected to reduce soil productivity under all alternatives. Impacts would be proportional to the number of acres treated under each alternative (see Table 1-2). Impacts would be greatest under Alternative 3, which would be expected to result in a 15 percent loss of productivity on approximately 4,300 acres for at least 20 years. Impacts would be negligible under Alternative 8.

Burning would result in depletion of soil organic matter, loss of nutrients by leaching and an increase in erosion by ravelling on steep slopes. Impacts of burning on organic matter and soil nutrients are well documented (Fredriksen 1972; Wells et al. 1979), but the relationship between these impacts and soil productivity is less clear.

Higher fire intensities would cause greater impacts on soil organic matter, nutrient leaching and, presumably, soil productivity. Loss of nutrients (e.g., calcium, potassium, phosphorous) through leaching would occur for approximately 2 years. Loss of soil organic matter, the major source of nitrogen and sulfur, would be of more concern, because these essential nutrients are in shorter supply in western Oregon forests. Prescribed burning as practiced today would minimize fire intensity, particularly in areas which have been gross yarded. Burning debris piles after scarification could severely burn 10 percent of an area, while only 6 percent or less of a broadcast burned area would be severely affected (Morris 1970 cited in Cramer 1974). Because long-term growth data is not available from past burns, effects of burning on soil productivity cannot be quantified.

Ravelling occurs naturally throughout the year on susceptible soils and rapidly accelerates when vegetation and surface debris are removed by burning. It results in decreased soil depth and loss of topsoil and acts as a physical deterrent to the reestablishment of vegetation. Little documentation is available on the effects of topsoil removal and soil depth reduction, but Power (1981b) and Klock (1979) have shown that topsoil loss results in decreased soil productivity. On steep south-facing slopes, ravelling may continue for 20 to 30 years after disturbance or until vegetation becomes reestablished.

The effects of burning on soil microorganisms would vary with locality and fire intensity. Intense fires would reduce microorganism populations most dramatically (Wells et al. 1979). Soil productivity could be enhanced or reduced by the

destruction of soil microorganisms, but impacts would be minor and short-lived.

Impacts on soils from burning would be similar under Alternatives 1, 2, 4, 5, 6 and 7. Impacts would be less under Alternative 8 because fewer acres would be burned. No impacts from burning would occur under Alternative 3.

Conclusions

Impacts to soils from compaction, topsoil removal, dry ravelling and nutrient depletion would be in proportion to the number of acres burned and/or scarified under each alternative. Some reduction of soil productivity would occur under all alternatives. These unavoidable adverse impacts would be greatest under Alternative 6 and least under Alternatives 3 and 8.

Impacts on Water Resources

Management of competing vegetation would be expected to have no effect on overall groundwater movement and streamflow in western Oregon. However, vegetation management could affect surface water quality. Potential impacts would include changes in dissolved solids concentrations, suspended sediment levels, herbicide levels and stream temperatures.

Concentrations of dissolved solids in stream water would be affected by management activities which alter normal nutrient cycling in the forest. Specifically, prescribed burning would be expected to increase concentrations of certain chemicals dissolved in stream water, most notably nitrogen. Tiedemann et al. (1978) found that concentrations of nitrate-nitrogen increased from less than 0.016 milligrams per liter (mg/l) to 0.56 mg/l following severe, summer wildfire in a central Washington Cascades watershed. Fredriksen (1971) reported nitrate-nitrogen concentrations of 0.2 mg/l following slash burning in the Oregon Cascades, a value 200 times the nitrate concentrations in an unburned control watershed. Fredriksen (1971) also reported elevated levels of ammonia-nitrogen and manganese following slash burning in the Oregon Cascades. Ammonia-nitrogen and manganese reached peak concentrations of 7.6 and 0.44 mg/l, respectively, in surface runoff that extinguished the slash fire.

Average concentrations of ammonia-nitrogen (1.19 mg/l) and manganese (0.11 mg/l) continued to exceed EPA recommended water quality criteria (0.5 mg/l for free ammonia, 0.05 mg/l for manganese) for 12 days.

Based on Fredriksen's study, prescribed burning would be expected to increase instream concentrations of nitrate-nitrogen as much as 200 times that of background levels of undisturbed forest watersheds. Increases would be expected to occur for 1 to 2 years after burning. Maximum concentrations of nitrate-nitrogen should remain less than 1 mg/l, well below the level of 10 mg/l established for drinking water supplies. Prescribed burning may cause ammonia-nitrogen and manganese to exceed EPA recommended water quality criteria for short periods in headwater streams that drain burned areas. Dilution by larger streams from unburned areas would quickly lower concentrations to within recommended levels. Based on acreages proposed for burning, Alternative 6 would have the greatest potential for impacting chemical water quality. Impacts from burning would be eliminated entirely under Alternative 3.

Suspended sediment concentrations may be affected by vegetation management activities, particularly those activities which impact the soil surface. Rice et al. (cited in Beschta 1978) found that the amount of soil erosion reaching streams is generally proportional to the amount of bare soil in a watershed. Increased sediment concentrations following broadcast burning have been recorded in both the Oregon Cascades and the Coast Range (Fredriksen 1970; Beschta 1978). These studies indicate that scarification and/or slash burning would be expected to increase suspended sediment concentrations in EIS area streams. The magnitude of impact from a treatment would depend on the amount of soil exposed, the intensity of the disturbance (i.e., the severity of the burn or the disturbance due to scarification) and distance to the nearest stream. Previous studies indicate that concentrations of suspended sediment return to natural levels, usually about 5 years following disturbance, as vegetation becomes reestablished on disturbed areas (Beschta 1978). Alternative 6 would have the greatest potential for increasing sediment concentrations, because this alternative calls for the highest combined level of scarification and burning.

Chemical methods of controlling unwanted vegetation can affect water quality. The likelihood of a herbicide entering surface water is dependent upon the persistence and mobility of the herbicide. The persistence of a herbicide is determined by its susceptibility to volatilization, microbial and chemical degradation and photodecomposition (see Glossary). The mobility of a herbicide is determined by its solubility and tendency for adsorption. Detailed information on the persistence and mobility of herbicides proposed for use under this EIS is presented in Ghassemi et al. (1981) and USDA, FS (1981) and is summarized in Appendix F.

Herbicide entry into streams would most likely occur through drift. According to Yates et al. (1978) and Witt and Montgomery (cited in Dost 1983), spray drift 100 feet downwind of the spray area during a 5 mph wind would deposit approximately 0.1 mg of herbicide per square foot for each pound of herbicide applied per acre. At 500 feet downwind of the spray area, about 0.005 mg of herbicide would be deposited per square foot/lb. applied/acre, and at one-quarter mile from the spray area, about 0.001 mg of herbicide per square foot/lb. applied/acre would be deposited.

Some herbicides could also enter streams in surface runoff or through erosion of soil previously treated with herbicides. Leaching of herbicides through the soil to the water table and to nearby streams is unlikely.

The BLM monitors water quality in conjunction with many spray operations. Water samples are collected at times when detection of herbicides is most likely, i.e., in the first 24 hours following herbicide application (to measure concentrations from accidental drift) and during the first major post-spray rainfall event (to measure concentrations carried by surface runoff or soil erosion). The results of BLM's water quality monitoring are summarized in Table 3-2, along with EPA recommended water quality criteria for selected herbicides. The table indicates that 82 percent of the analyzed water samples showed no detectable levels of herbicides. Less than 0.5 percent of the analyzed samples exceeded the recommended level for a 24-hour mean concentration. Three samples from one atrazine spray unit exceeded the recommended level of 50 parts per billion (ppb) for the 24-hour mean. These samples were the result of an accident based upon unusual circumstances not expected to be repeated. Samples taken 24 hours later on this stream showed herbicide concentrations less than 10 ppb.

Based on the data in Table 3-2, BLM spray operations would be expected to rarely cause stream contamination that would exceed EPA recommended criteria. Potential for impacting water quality from spray operations would depend upon the number of acres to be sprayed and the restrictions imposed under each alternative. Potential water quality impacts would be greatest under Alternatives 2 and 3, decreasing to least under Alternatives 7 and 8.

Management of competing vegetation, particularly broadcast burning, could affect stream temperatures by removing shading vegetation along stream channels. Stream temperature increases of 10° F or more have been recorded following removal of streamside vegetation in both the Oregon Cascades and Coast Range (Brown and Krygier 1970; Levno and Rothacher 1967). While BLM's vegetation management practices would incorporate design features to protect streamside vegetation, it would not always be possible to protect the vegetation along every small headwater stream from the effects of broadcast burning or accidental drift of herbicide spray. For this reason, Alternatives 1, 2 and 5, which propose the highest levels of broadcast burning and aerial spraying, would have the greatest potential for increasing stream temperatures on small headwater streams. Streams warmed by exposure would not be significantly cooled by downstream shading, but temperatures of these streams would be lowered by mixing with cooler tributaries or groundwater (Brown 1974). Mechanical and hand treatment of unwanted vegetation would be expected to less affect stream temperature, because these methods provide better control for protecting streamside vegetation.

Management of competing vegetation is expected to have no significant impact on groundwater

Table 3-2 Water Quality Monitoring of BLM Spray Projects, 1977 to 1982.

Herbicide	Total Analyzed	With No Residue	Number of Samples 0-10 ppb[1]	11-30 ppb	31-50 ppb	51-100 ppb	101-500 ppb	Maximum Observed Concentration (ppb)	Recommended 24-hour Mean Concentration[2] Irrigation (ppb)	Drinking (ppb)
Asulam	1	1	-	-	-	-	-	-	-	-
Atrazine	221	166	48	6	-	-	2	503.0	50	50
Dalapon	168	150	4	7	3	4	-	70.0	100	500
Triclopyr	30	20	10	-	-	-	-	3.8	-	-
Fosamine ammonium	2	2	-	-	-	-	-	-	5,000	5,000
Picloram	21	19	2	-	-	-	-	1.1	1	500
Glyphosate	97	86	10	-	1	-	-	35.0	-	-
Hexazinone	7	7	-	-	-	-	-	-	-	-
2,4-D	337	268	67	2	-	-	-	16.8	50	50

[1] ppb = parts per billion

[2] Newton and Norgren (1977, Table 2, P. 77). These criteria are for 24-hour mean concentrations for streams flowing less than 10 cubic feet per second and are not directly comparable to the individual sample concentrations from BLM spray monitoring. Sample concentrations from BLM monitoring would tend to be higher than 24-hour mean (average) concentrations because spray monitoring is concentrated in the period immediately following herbicide application, when concentrations are likely to be highest. Twenty-four-hour mean concentrations downstream from BLM spray operations would be lower than the concentrations of individual samples.

quality. Concentrations of ammonia-nitrogen and nitrate-nitrogen may increase in soil water after broadcast burning due to decreased nutrient uptake by vegetation. This impact would be short-term and local and would not significantly affect water quality for any use. Herbicide application would have no impact on groundwater quality, as available information (Ghassemi et al. 1981; USDA, FS 1981) indicates that herbicides are rarely leached below the top 10 inches of soil.

Conclusions

None of the alternatives would significantly affect regional streamflow and groundwater movement. Unavoidable and adverse impacts on water quality would vary by alternative. Because burning and scarification have the greatest potential for disrupting nutrient cycling and exposing bare soil, Alternative 6 would be most likely to increase suspended sediment and dissolved solids concentrations, mostly notably nitrogen. Potential for herbicides entering surface water would be greatest under Alternative 3, which proposes the largest acreage for treatment with aerial application. Water temperatures of small headwater streams would be most likely to increase under Alternatives 1, 2 and 5 because protection of streamside vegetation would be more difficult when burning and aerial spraying than when using other treatment methods.

Impacts on Vegetation

Terrestrial Vegetation

Management of competing vegetation would have both beneficial and adverse impacts on terrestrial vegetation within the western Oregon BLM districts. Both target and nontarget vegetation in areas scheduled for treatment would be directly affected. The degree to which vegetation would be affected would depend on the types of treatment used and the number of acres treated under each alternative (see Table 1-2). The overall effect of managing competing vegetation would be to accelerate succession through the grass-forb and brush-seedling seral stages (see Table 2-2), reducing the total amount of BLM-administered land occupied by vegetation of these seral stages.

Burning

Burning would temporarily eliminate or suppress competing vegetation, improving conifer survival. By exposing mineral soil, however, burning would also promote the subsequent invasion of grasses, forbs and hardwoods. The germination of some competing shrubs such as manzanita and ceanothus would be stimulated by burning, most often in the Mixed Conifer, Mixed Evergreen and Ponderosa Pine Zone forests of southwestern Oregon.

Intense burns would be more likely to kill vegetation roots than light burns. Past research (Morris 1970 cited in Cramer 1974) indicates about 6 percent or less of a treated area would be severely burned, and 55 to 75 percent would be lightly burned. Lightly burned acres would have a higher percentage of herbaceous and brush cover present within 2 years after burning. However, growth of this vegetation would be delayed, providing more competition-free growing time for conifers than would be available in most unburned areas.

Risk of wildfire from escaped slash burns would not be significant under any alternative. From 1980 to 1982, 4.5 percent of BLM slash burns resulted in wildfires. These wildfires accounted for 2.9 percent of all acres burned by BLM in western Oregon.

Impacts on competing vegetation from burning would be similar under Alternatives 1, 2, 4, 5, 6 and 7. Impacts would be less under Alternative 8 because fewer acres would be burned. Alternative 3, which would not allow burning, would result in reduced reforestation success and an estimated 4 percent reduction in western Oregon BLM's annual timber sale program.

Chemical Treatments

Herbicides impact the species composition, size, density and vigor of vegetation. Impacts on vegetation would range from complete control to negligible damage depending on species, chemicals used, dosages and timing of applications.

Herbicides used for site preparation, maintenance and release would usually result in a large percentage of brush and hardwood defoliation, a fair amount of topkill (see Glossary) and minimum resprouting. Treatments would not necessarily eliminate all competing vegetation but would temporarily reduce competitors, increasing the amount of light reaching conifers and decreasing brush and grass competition for soil moisture and nutrients. Impacts of herbicides would be greater on plant sprouts or seedlings than on full-crowned, mature plants. Use of herbicides would also reduce habitat of rabbits and rodents which would otherwise occupy planted areas and feed on young conifers.

Chemical release would increase the growth rate of young conifer seedlings stressed by competing vegetation. In a western Oregon study (Gratkowski and Lauterback 1974), selected herbicides were used to release Douglas-fir from ceanothus. Height growth of young Douglas-fir was reported for a 5-year period after release. Percentage increase in height growth over nonreleased trees

varied from 130 percent (for trees 1 foot high when spraying occurred) to 149 percent (for trees 6 feet high) in basal spray plots and from 255 percent (for trees 1 foot high) to 171 percent (for trees 6 feet high) at aerial spray locations. Another study showed diameter growth of trees in sprayed areas was 2 to 2.5 times that of trees in unsprayed areas 5 to 6 years after treatment (Lauterback 1967).

Oil carriers would also impact vegetation. In addition to improving spray coverage and herbicide penetration, diesel carriers in themselves could damage or kill plants. Occasional damage would occur to individual conifers which began bud break earlier than the majority of conifers in a spray unit.

Based on acreages proposed for treatment, impacts of herbicides on vegetation would be greatest under Alternative 3, and progressively less under Alternatives 2, 1, 5, 4 and 6. Alternatives 7 and 8, which would not allow herbicide use, would result in reductions of 19.7 percent and 34 percent, respectively, in BLM's annual timber sale program.

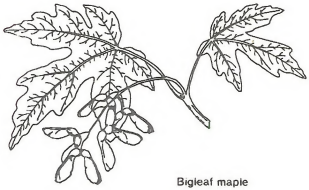
Under Alternatives 1 through 5, nontarget vegetation immediately adjacent to spray units could be adversely affected by herbicides drifting beyond unit boundaries. Such impacts would be reduced, but not eliminated, by buffer strips and application techniques (Gratkowski 1974).

Mechanical Treatments

Scarification would remove most of the brush in treated areas, killing over 70 percent of the root systems (Newton and Dost 1981). By exposing bare mineral soil, scarification would aid germination of light-seeded species such as grasses and hardwoods. On scarified units where grass establishes itself as the dominant vegetation, conifer seedlings would suffer increased moisture stress and damage from rodents and deer. Damage to conifers from animals could also increase if slash were piled during scarification and left unburned, because piles would provide excellent habitat for rodents. In addition, piling would impact conifer stocking by decreasing plantable acres.

Mechanical cutting (i.e., with Hydro-axe) would have little effect on root systems, increasing the incidence of sprouting. Many competing species such as bigleaf maple, tanoak, blackberry and salmonberry would thrive on repeated cuttings and form dense, vigorous hedges of sprouts.

Scarification, piling and cutting would be most effective in controlling competing vegetation when used in combination with other site preparation methods. Scarification by itself would expose bare mineral soil, aiding germination of light-seeded species such as grasses and alder. Some shrubs would resprout from surviving root systems. The result would be open stands of hardwoods and brush surrounded by a dense cover of grasses and forbs (Newton and Dost 1981).



Bigleaf maple

Impacts of mechanical treatments would be greatest under Alternative 3, and progressively less under Alternatives 6, 7, 1, 5, 4 and 2. Vegetation would not be impacted by mechanical treatments under Alternative 8.

Manual Treatments

Manually cutting brush and hardwoods for both site preparation and release would temporarily reduce competition. However, studies and field observations indicate that within 6 months to 2 years after treatment, sprouts of vine maple, red alder and salmonberry would regenerate to their original height, and brush density would increase fivefold (Roberts 1980). Another study revealed a 1,327 percent increase in stem density of selected southwestern Oregon broadleaf evergreen species 2 years after treatment (Personal communication, Stephen Hobbs, Adaptive FIR). These impacts would be most pronounced in Mixed Conifer and Mixed Evergreen Zone forests due to the abundance of prolific sprouting species in these zones. In addition, manual cutting could result in injury to more than 20 percent of released conifers from saws, falling debris and shock from exposure (Roberts 1980).

Mulching would prevent the growth of grass and increase available moisture to conifers. A 1982 study in the Roseburg District revealed a 93 percent survival rate on mulched plots containing Douglas-fir seedlings after three growing seasons. On slopes greater than 65 percent, mulch could slip downhill and damage conifer seedlings.

Salmonberry

Scalping would temporarily remove competing vegetation from individual planting spots. Vegetation with extensive root systems, particularly some grasses, would quickly regenerate in most areas. Occasional damage to seedlings could occur if scalping were done after planting. Overall, scalping would not significantly impact vegetation.

Hand pulling would completely remove competing plants from individual planting spots. Conifers would remain free from competition until other species invaded from surrounding areas. Since this practice would be limited primarily to young ceanothus, scotch broom and manzanita plants, overall impacts would be insignificant.

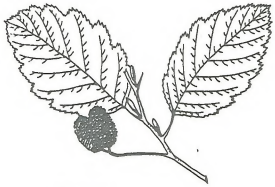
Based on acreage treated, impacts on vegetation from manual treatments would be greatest under Alternative 7, and progressively less under Alternatives 6, 3, 4, 5, 1, 2 and 8.

Biological Treatments

Seeding selected grasses and forbs on units immediately following burning or scarification would retard or prevent invasion of light-seeded brush and hardwood species. Seeding would only be effective in portions of vegetation zones where there would be little or no competition for moisture. In such areas, grasses and forbs would have little effect on conifer survival and growth compared to losses caused by brush and hardwoods (Klingler 1980).

Properly managed, sheep could be effective in removing competing vegetation on selected sites with limited damage to conifers. Sheep reduce palatable grasses, forbs, sprouts and low top growth of several species of shrubs, leaving taller and less palatable species (Sharrow and Leininger 1982).

No impacts from biological treatments would occur under Alternative 8. Overall impacts under the other alternatives would be negligible because of the limited number of acres that would be affected.



Red alder

Precommercial Thinning

Impacts of precommercial thinning on vegetation would be similar to those of release treatments. Although some damage would occur to released conifers by accidental cutting or by falling trees, precommercial thinning would increase merchantable volume (see Glossary) by 20 to 25 percent (Curtis et al. 1982). As with manual release cutting, manual precommercial thinning would leave a dense slash layer on the ground that could not be burned, creating a fire hazard for 3 to 5 years. In contrast to manual cutting, herbicide injection would leave trees standing and would not generate a dense slash layer. This would reduce fire hazard and accidental injury to conifers. Herbicide injection could adversely affect released conifers if chemicals were absorbed through root contact with injected trees. Impacts from precommercial thinning would be similar under Alternatives 1 through 7. No precommercial thinning would be done under Alternative 8.

Threatened or Endangered Plants

Unidentified populations of threatened or endangered plant species could be susceptible to any impacts described under terrestrial vegetation. Direct effects of injury or death to plants could cause the immediate elimination of a species in all or a significant portion of its range. The more subtle effects of vegetative community changes could cause the eventual elimination of a species on a specific site locally through loss of competitive ability relative to other vegetation.

If any species of vascular plant is determined by the U.S. Fish and Wildlife Service to be threatened or endangered, any action that would contribute to its extinction or to its threatened or endangered status would be in violation of the Endangered Species Act of 1973 as amended. Therefore, environmental analysis accomplished prior to any site-specific action would document any threatened or endangered plant species known to be present on the site and identify appropriate measures to be taken to protect the species.

Conclusions

The overall impact of all alternatives would be to suppress competing vegetation, thereby increasing conifer survival and growth. The greatest levels of vegetation control would be provided under Alternatives 1 and 2 (see Table 1-2), which would include the full range of vegetation management practices and would treat the largest number of acres through burning or herbicide application. Less impact on competing vegetation would occur under Alternatives 3 through 7, which restrict or preclude some treatments. Alternatives 3 and 7 would result in reductions of 4 percent and 19.7 percent, respectively, in BLM's annual timber sale program. Alternative 8 would least impact competing vegetation, resulting in the lowest level of conifer survival and a 34 percent reduction in BLM's annual timber sale program.

Herbicides would provide greater control of resprouting vegetation than other treatments, particularly when applied prior to burning. Suppression of most competing vegetation through manual cutting would be temporary because sprouts would quickly regenerate, increasing brush density to above pre-treatment levels. Mechanical treatments would temporarily remove competing vegetation from sites but would aid germination of grasses and hardwoods.

Impacts on Animals

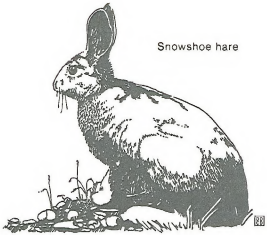
Terrestrial Vertebrates

Impacts on wildlife from vegetation management would be beneficial or adverse, depending on the animal species affected and the treatments used under each alternative. Although some treatments (i.e., grass/forb seeding) would provide short-term benefits to some wildlife species, the overall long-term results of controlling competing vegetation would be reduced habitat diversity with a corresponding reduction in wildlife species abundance and diversity. Most detrimental to wildlife would be cumulative impacts resulting from successive treatment of sites and/or from treating a number of closely-spaced sites within a short time period. Adverse impacts on wildlife populations could be reduced by treating no more than 25 percent of the 0-15-year seral stages within a wildlife habitat area (see Glossary) during any 3-year period.

Burning

Broadcast burning would destroy animals unable to flee treated areas or escape into burrows. Spring burns (March through June) would destroy nests with eggs and young hidden in vegetation. Burning during the nesting season could also cause raptors and herons to abandon nest sites adjacent to treatment areas. Such abandonment would result in the loss of young or failure to produce offspring during the year. Burning slash piles would destroy few animals since species inhabiting piles could easily escape.

Wildlife habitat would also be impacted by slash burning. Effects on ground cover would vary with burn intensity. Lower intensity burns on wet sites would remove less ground cover than higher intensity burns on dry sites. Loss of small ground cover and charring of larger branches and logs (more than 3 inches in diameter) would be detrimental to some birds (e.g., woodpeckers, chickadees) and to some small mammals (e.g., weasels, rabbits, deer mice) that use forest residues for food or shelter. Charring of large branches and logs would also be harmful to insects, an important link in the food chain. Burning of downed woody material would cause a long-term reduction of this important habitat in managed forests of the future.


Snowshoe hare

Leaving an average of two snags per acre would be necessary to maintain viable populations (see Glossary) of cavity nesting animals (USDA, FS 1982). However, nearly all snags in timber harvest units are removed during logging operations. The few remaining snags or trees retained for wildlife are felled if they might increase fire hazards during slash burning. Because snags develop slowly, their removal would have a long-term impact on the abundance and diversity of species dependent upon snag habitat.

Grasses and forbs normally begin growing vigorously within a few months after slash burning, providing habitat for animals adapted to early seral stages. Burning improves the quality and palatability of forage for big game (Yoakum et al. 1980). Crouch (1974) indicated that slash burning increased the food supply of black-tailed deer. Harper (1969) found higher Roosevelt elk use on burned logging sites than on unburned sites, a difference he ascribed to the greater abundance of grasses on burned areas. However, Harper believed slash burning would not necessarily increase forage on all sites, because each site varies in its response to burning. Burning would also benefit deer and elk by removing obstructions to their use of forage areas (Crouch 1974).

Based on acreage treated, impacts from burning would be similar under Alternatives 1, 2, 4, 5, 6 and 7. Impacts would be less under Alternative 8 and eliminated under Alternative 3.

Chemical Treatments

Herbicides significantly modify wildlife habitat by suppressing grasses, forbs, brush and hardwoods in favor of conifer development. This reduces habitat diversity and stratification, adversely impacting those animals that utilize the grass/forb and brush/seedling seral stages.

Harper (1971) reported that elk in western Oregon were adversely affected when ground forage was removed with herbicides but were benefited by the opening of dense brushfields. Black (1970) found that deer use increased on treated areas 1 year after treatment. Generally, increases or decreases in forage would be temporary, but in important habitats within the EIS area such as big game winter range, fawning and calving grounds or small year-round habitat areas, substantial decreases in forage could reduce local big game populations. Such decreases in forage would be likely to occur in localized areas under all alternatives except 7 and 8.

Snags remaining after logging are occasionally felled to reduce hazards to aircraft during aerial herbicide spraying. In the long term, this practice would reduce populations of animals dependent upon snag habitat.

Known raptor and heron nesting sites would be avoided during the January through August nesting season. However, aerial herbicide applications near unidentified nest sites could cause abandonment of nests, resulting in loss of young or failure to produce offspring.

Although herbicide use would temporarily increase forage for some species, the anticipated overall impact of shortening early successional stages and reducing vegetation diversity would be to reduce wildlife populations. This adverse impact would be greatest under Alternatives 1, 2 and 3 and would result in little change from existing population levels under Alternatives 4, 5 and 6. Herbicides would not be used under Alternatives 7 and 8.

Exposure to acutely toxic levels of herbicides is not anticipated as none of the herbicides proposed for use have been reported to be highly toxic to animals when used in accordance with manufacturers' labels. Animals are unlikely to ingest toxic amounts of herbicides at levels applied in forest management since herbicide spray is very unlikely to contact all forage in treated areas (Rodd and Genelly 1956; Springer 1957; Mellanky 1967; Montgomery and Norris 1970; Norris 1971), and some animals are repelled by herbicide residues on their natural food (Springer 1957).

Chronic (long-term) effects of herbicides on wildlife are not anticipated. Animals are not likely to be exposed to repeated treatments, and

herbicide residues ingested by them are excreted, tending not to concentrate in body tissues (Newton and Norris 1968). Detailed discussions of the toxicity of chemicals proposed for use under this EIS can be found in Appendix F and in Ghassemi et al. (1981), USDA, FS (1981) and USDE, BPA (1982).

Diesel oil is often used as a carrier for forest herbicides. Data are insufficient to predict the impacts of diesel oil carriers on animals in the EIS area, but direct loss is likely to be low. Adult ducks are known to be adversely affected at dosages higher than those used in normal forest applications (Hartung 1965, 1966; Tucker and Crabtree 1970). Diesel oil can also coat eggs, reducing hatching success (Kopischke 1972), and can coat birds, increasing their vulnerabilty to other environmental stresses such as predation and hypothermia. Early spring application of herbicides in diesel oil carriers may reduce nesting success of some birds (USDE, BPA 1982).

Mechanical Treatments

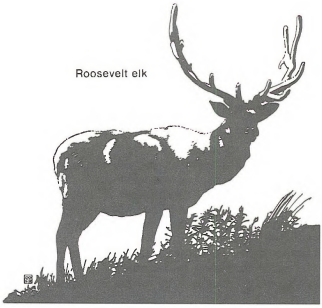
Mechanical piling of slash during scarification would result in soil compaction, damaging subterranean habitat used by some burrowing animals. Piling would remove downed slash that hinders movement of deer and elk but may create large barriers if slash is windrowed. Removal of downed woody material would reduce habitat for many small wildlife species.

Gross yarding for site preparation normally removes logging slash as small as 6 to 8 inches in diameter and 8 feet in length. This would reduce new habitat made available to birds and small mammals by timber harvest. Gross yarding would benefit big game by improving access through treatment areas and increasing availability of forage.

Impacts from mechanical treatments would be greatest under Alternative 3 and considerably less under the remaining alternatives.

Precommercial Thinning

Precommercial thinning, although it may open a young forest canopy, generally does not benefit deer and elk because the unremoved slash impedes movement. The obstacle presented by slash accumulations restricts deer and elk from utilizing any forage increases which result from the thinnings. Cover use is also restricted by slash accumulations. Therefore, reduced deer and elk use would occur on those acres precommercially thinned (see Table 1-2). This condition could last as long as two decades before decomposition removed the obstacles.


Roosevelt elk

Conversely, birds and small mammals may increase their use of an area following precommercial thinning. Slash accumulations provide cover for them, and any increases in forage production can be utilized.

Impacts from precommercial thinning would be similar under Alternatives 1 through 7. No precommercial thinning would be done under Alternative 8.

Fish

Vegetation management activities can impact fish and aquatic habitat by causing changes in food sources, water temperatures, water chemistry and condition of bottom materials. Chapter 3, Impacts on Water Resources, provides information on potential changes in sediments, organic matter and water quality. Many analyses and conclusions appearing in this section are based on those data.

To avoid or minimize vegetation management impacts on aquatic habitat, the Bureau employs a number of protection measures. Buffer strips (see Glossary), stream cleaning and equipment restrictions are typical of past efforts. The alternatives provide a range of protection. Alternatives 1 and 3 through 8 would maintain protective buffers on all flowing streams. Under Alternative 2, requirements for protecting first and second order streams (see Glossary) would be less stringent than under the other alternatives.

Bottom material (boulders and gravel) with a minimum of sediments (see Glossary) is essential to the health of fish populations. In the EIS area, excessive amounts of sediment in fish habitats result primarily from landslides caused by surface-

disturbing activities near channels (see Chapter 3, Impacts on Soils and Water Resources). Excessive sediments temporarily affect fish by reducing aquatic food sources and by cementing or covering gravel. This reduces dissolved oxygen and eliminates or reduces spawning, incubation and rearing of young fish. According to Gibbons and Salo (1973), excessive sediments have the greatest impact of all factors affecting aquatic life. Suspended sediments would be reduced from present levels under Alternatives 3 and 8 due to reductions in burning and/or scarification. The remaining alternatives would increase sediments over present levels in some localized stream reaches, but increases would not be expected to significantly affect fish habitat.

Aquatic and terrestrial invertebrates (mainly insects) are the major food sources for young salmon and trout. According to Erman et al. (1977), undisturbed buffer strips at least 30 meters (about 100 feet) wide on each side of a stream are required to maintain insect populations. Insects falling from multistoried vegetation are widely dispersed over adjacent water, providing a constant and plentiful source of food. Food sources in small headwater streams would decline under Alternative 2 due to less stringent buffer zone requirements.

Water temperatures are critical for optimum fish production. Reduction of riparian zone vegetation would likely increase summer and decrease winter water temperatures. High summer water temperatures could reduce dissolved oxygen, increase the incidence of fish disease, block upstream fish passage, overcrowd juvenile rearing areas and reduce food production. Low winter water temperatures could slow egg incubation. Impacts on fish due to changes in water temperatures would likely occur under Alternative 2. Temperature changes under the remaining alternatives would not significantly affect fish production.

Chemicals proposed for use in vegetation control, at their levels of application, are not expected to significantly affect fish or their habitat under any alternative. Proposed application rates are well below known lethal doses for laboratory tested fish species, and toxic effects are not expected (Ghassemi et al. 1981; USDA, FS 1981). Available data indicate that herbicides accumulate in fish to a very limited extent and are quickly excreted in clean water (Dost 1983).

The condition and trend of individual habitat components have a direct bearing on fish populations. When all components are adequately protected, fish populations will be maintained and will probably increase over existing levels. When one or more components are severely impacted, fish populations will remain below potential levels (Reiser and Bjornn 1979; Everest and Harr 1982). Under existing conditions, streams in the BLM districts are considered to be producing fish at 50 percent of potential levels. Under Alternative 2, fish production would decline slightly by the fifth decade. The remaining alternatives would not significantly change fish production from present levels.

Threatened or Endangered Animals

Threatened or endangered species receive special attention under the provisions of the Endangered Species Act of 1973, as amended, and BLM policies and guidelines. Known nest and roost sites of listed species are avoided or special precautions taken to ensure their well-being (see Chapter 1, Vegetation Management Treatments and Design Features). No adverse impacts are expected to occur to these existing sites.

Conclusions

Short-term benefits to some terrestrial animals would occur under all alternatives, but overall, control of competing vegetation under Alternatives 1 through 5 would unavoidably reduce terrestrial animal populations and diversity from present levels. Alternatives 1, 2 and 5 would have moderately adverse impacts on terrestrial wildlife, particularly big game and song birds, because they would result in the greatest number of acres treated and would include the full range of vegetation management practices. These alternatives would reduce availability and variety of big game forage, reduce nesting and foraging habitat for many song birds, and reduce snag habitat for woodpeckers and other cavity nesters. Alternatives 3 and 4 would result in slightly adverse impacts to most terrestrial animals. Alternatives 6 and 7 would probably not reduce animal populations below present levels. Alternative 8 would maintain or slightly increase wildlife diversity by maintaining unaltered early seral stages. Most game fish populations would be expected to decline slightly under Alternative 2 due to reduced requirements for streamside buffers, but would not be significantly impacted under the remaining alternatives.

Impacts on Cultural Resources

Complete field surveys of the BLM districts to identify cultural sites have not been undertaken. However, surveys would precede specific management actions that could result in damage to cultural resources (BLM Manual 8100, Cultural Resource Management). Under all alternatives, sites identified during these surveys would be protected in accordance with the National Historic Preservation Act of 1966 and Executive Order 11593, as stated in the Code of Federal Regulations (36 CFR 800).

Cultural resources not identified by field survey could be inadvertently impacted under all alternatives. The potential for damage would vary with the amount of ground disturbance and burning that would occur under each alternative. Scarification could damage artifacts and disrupt relative positions of cultural materials. Mixing organic matter in archeological sites could contaminate Carbon 14 dating samples, making them unreliable for scientific analysis. Uncovering sites could increase the possibility of illegal artifact collecting. Burning for site preparation could destroy combustible cultural materials and damage stone and ceramic artifacts.

The number of undiscovered sites that could be impacted cannot be estimated. Impacts to a site could obliterate structural remains and subtle indications of prehistoric activity. The top 12 to 18 inches of prehistoric sites with subsurface deposits could be severely impacted. The potential for impact would be greatest under Alternative 7 and least under Alternative 8.

Impacts on Recreation and Visual Resources

Vegetation management treatments such as scarification, burning and herbicide application cause visual impacts primarily by creating color contrasts between treated areas and surrounding vegetation. Scarification disrupts the land surface and exposes bare soils to view. Herbicide application, in addition to causing color contrasts, reduces vegetative variety and can prevent the occurrence of seasonal changes (spring flower, fall color) within treated areas. Burning creates contrasting blackened areas and releases smoke into the air, which temporarily impairs visibility. However, burning does lessen the amount of logging debris that is seen and darkens the color of stumps and snags that, if not burned, would become more noticeable as they bleached over time.

Since the boundaries for most vegetation management projects such as scarification and burning would conform to the boundaries of units just harvested, visual impacts described above would occur in areas where the more significant impacts of timber harvesting have already taken place. Nevertheless, the various treatments would make clearcuts more noticeable and would prolong the time required for the areas to "green-up" with naturally invading grasses and forbs and to blend with surrounding vegetation. These short-term "secondary" impacts would be partially offset, in the long term, where treatments enhanced the survival and growth of planted seedlings.

Most vegetation management practices would occur in visual resource management (VRM) Class IV areas (approximately 90 percent of the land base). Because these public lands are generally of low to moderate scenic quality, are low sensitivity areas seldom seen by most people, and are intermingled lands primarily managed for timber production, visual and recreation impacts in VRM IV areas under all alternatives would be low. Use of public land for hunting, berry picking and other dispersed activities will continue to occur but will shift away from treated areas when resource availability is reduced to the point where recreation experience expectations cannot be realized. Impacts of smoke and herbicide residue on the health of forest visitors are discussed in Chapter 3, Impacts on Human Health.

Visual and recreation impacts would also be low in VRM II and III areas such as developed recreation sites, hiking trails and along State scenic highways and rivers. Under Alternative 8, the appearance of recreation sites and other developed areas would deteriorate as they became overgrown with undesirable vegetation. Under Alternatives 1 through 7, some vegetation management practices would take place within and adjacent to some of these areas, and the effects of these practices would be seen. Such site-specific impacts would be analyzed in district environmental assessments prepared on detailed vegetation management plans. Impacts of the vegetation management program on areas with special designations are discussed in the following section, Impacts on Special Areas.

Impacts on Special Areas

All vegetation management treatments applied near designated or proposed Research Natural Areas, Outstanding Natural Areas, National Wild, Scenic or Recreation Rivers, National Scenic or Recreation Trails, State Scenic Waterways, State Recreation Trails or Areas of Critical Environmental Concern would incorporate

features designed to avoid or mitigate impacts on important resource values. However, important plants, animals, habitats, scenic qualities or recreational values could be damaged or destroyed where aerial herbicide spray drifted from adjacent target areas or where nearby slash fires escaped.

The probability of adversely impacting special areas would generally correspond to levels of burning and aerial herbicide spraying under each alternative. Impacts would be most likely under Alternative 2, which would treat the most acres by burning and aerial spraying, and least likely under Alternative 8. Site-specific impacts to special areas will be further analyzed in environmental assessments which will precede each vegetation management action.

Impacts on Human Health

Burning

Based on information in Chapter.3, Impacts on Air Quality, smoke from burning would not be expected to impact human health significantly under any alternative. Levels of suspended particulates (a suspected factor in some health problems) are expected to be well below the 150 ug/m^3 public welfare standard and the 260 ug/m^3 public health standard published by EPA.

Workers on burn areas would be exposed to potential injury due to the manual treatments they would perform and the conditions under which they would work (see discussion under Manual and Mechanical Treatments below). Workers manually lighting burn areas would be exposed to the additional hazards of falling rocks, rolling logs and burning materials, which could cause physical injury. These hazards would be reduced where helicopters were used instead of ground personnel to light burn areas.

Assuming normal safety precautions are taken for working around gasoline, there would be no significant hazard associated with mixing of gelled gasoline.

The probability of workers on burn areas being physically injured would be approximately the same under all alternatives except 3. Injuries associated with burning would not occur under Alternative 3.

Public safety would not be affected by any method of igniting burn areas. Most burning would be done in locations where the public would either not be present or would be very visible to those doing the burning. Further, any people present on or near a burning area would be well aware of impending activities, since several hours of active preparation are required before ignition begins. Safety measures normally taken to protect firefighters participating in the burning operation would also protect the public.

Manual and Mechanical Treatments

Physical injury could result from mechanical and manual vegetation control activities. Workers would be exposed to steep, brushy, uneven terrain, making them vulnerable to slips, trips and falls with associated injuries. This working environment also increases the hazards of working with cutting tools such as axes, brush hooks, machetes and chain saws. Exposure to poison oak, ticks and poisonous snakes also presents risk of injury. Operators of machinery could be injured by losing control of equipment or by coming into contact with flying debris and brush.

Injury frequency rates indicate the hazards of various vegetation control methods. Brush cutting injuries reported by the Bonneville Power Administration for the period 1976 through 1980 ranged from 2.5 to 10.3 injuries per 200,000 man-hours worked. During the same period, no chemical toxicity injuries or helicopter related injuries were reported (USDE, BPA 1982). Dost surveyed the Oregon State Accident Insurance Fund records for 1978-1979 to assess injury rates associated with forestry practices. Among the major items reported were strains and bruises (46.6 percent of reported accidents), eye injuries (8.6 percent), chain saw cuts (7.0 percent), poison oak reactions (5.7 percent), fractures (4.8 percent), and vehicle and equipment accidents (4.8 percent) (Dost 1981). Based upon the number of acres treated with manual and/or mechanical methods, injuries would be most likely under Alternatives 3 and 7 and least likely under Alternative 8.

Chemical Treatments

Herbicides are intended to be toxic to plants. They are designed to interfere with vital plant processes such as seed germination, hormone (auxin)-mediated growth and development and photosynthesis, which are processes that do not occur in animals. Basic biological and physiological differences between plants and animals partly account for the relatively low toxicity of herbicides to animals.

The primary impacts on human health from chemical treatments depend upon the toxicity of the chemical and the level of human exposure. It is clearly established that all chemical effects on

biological systems follow a dose-response relationship; that is, as dosage increases so does effect, and vice versa. The chemicals of concern in this document are not considered to have significant mutagenic or carcinogenic impact. For such chemicals, it is possible to establish a no-observed-effect dose which is the highest dose that causes no toxicologic change in exposed animals (the term threshold is also used to identify this dose range). Chemical exposure may be brief (acute) or prolonged (chronic). The terms acute and chronic may be used to describe duration of effect as well as duration of exposure. The kind of response (acute or chronic) observed in organisms depends on the route of intake (i.e., oral, dermal, inhalation) and frequency of exposure, coupled with the specific mechanisms of toxicity. A chemical of high toxicity may represent no or limited hazard if exposure and dose are very low, just as a chemical of limited toxicity may be quite hazardous if exposure is high.

Extensive studies of the absorption, distribution, metabolism and excretion of herbicides in animals (USDE, BPA 1982) have shown that the herbicides of concern in this document and their metabolites are rapidly eliminated from most animals and do not substantially accumulate in animal tissues. This further reduces the possibility that exposure will result in harmful consequences.

A frequently used term is the accute oral LD_{50} which is the dosage of toxicant, expressed in milligrams of toxicant per kilogram of animal body weight, required to kill 50 percent of the animals in a test population when given orally. The oral LD_{50} value is a useful general guide for comparing the acute toxicity of chemicals, but because the acute toxicity of most herbicides is low, it is not used as a basis for comparing hazards. Acute dermal (skin contact) toxicity levels are almost always less than acute oral levels, and though dermal exposure is most common, are also of limited use except when an unusual response is found in the laboratory and except for juding topical irritant potency. Table 3-3 shows the relative oral LD_{50} toxicity levels of herbicides proposed for use under this EIS.

Of concern is the probability that use of a chemical will result in irreversible disease such as reproductive or genetic effects. Reproductive effects include infertility, miscarriage, general fetal toxicity or birth defects (teratogenesis). Genetic effects are those that involve alteration of cellular DNA (see Glossary) and could result in cancer or mutations. Almost all chemicals will produce reproductive effects in the laboratory at some dose, although some cause maternal death before any detectable impact on the fetus occurs. Very few chemicals, of the great number in commerce that have been tested, have been shown to cause cancer, and few have significant mutagenic activity in the variety of tests currently used to screen for genetic activity.

Possible reproductive effects may be straightforward toxicity to the fetus, ranging from completely reparable effects to lethal damage, or may be true teratogenic activity in which the development of the fetus goes awry, resulting in malformation. Such effects may be caused either by direct impact of the chemical during the period of organogenesis, or by genetic damage in one or both parents prior to conception. The latter effect is a mutational effect, and risk of such impact is considered in that category. A characteristic of chemical teratogenesis is that a threshold of effect exists, just as is the case for all nongenetic insults.

Of the chemcials proposed for use, none is established as having carcinogenic effect. However, existing negative assays on several chemicals have been questioned because of inadequate procedures or analysis, and are being redone. One, (fosamine) was not assayed for carcinogenic effect because no food tolerances were intended. Tests are now in progress. Diuron and 2,4-D have shown evidence of carcinogenicity in tests that were improperly carried out and reported, thus are of questionable value in judging hazard.

It should be pointed out again that the dose-response relationship applies to carcinogens as well as other chemicals. For purposes of risk assessment and regulation, the probability of genetic effect from such chemicals can be estimated, using the assumption of a linear dose response. If the maximum estimated exposure is low enough that expected incidence is, for example, one case in a million lifetimes or less, it is generally considered to represent an effect of virtually zero.

The issue of herbicide carcinogenicity has been raised in the case of 2,4-D and was reviewed by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) scientific advisory panel for the U.S. Environmental Protection Agency (EPA) in June of 1980. Their report, addressing work by Hansen et al. (1971) and Reuber (1979) stated:

"The FIFRA Scientific Advisory Panel has reviewed the chronic toxicity study on 2,4-D carried out in rats and dogs by Hansen et al. which was published in Toxicology and Applied Pharmacology (TAP). In addition to peer review of this study by the editor and editorial board of TAP, the study has also been reviewed by the National Cancer Institute (NCI) and by Dr. M. Rueber. The NCI review agreed with the conclusion of the

authors of this paper that a carcinogenic effect was not demonstrated for 2,4-D whereas Dr. Rueber's conclusion was that 2,4-D is carcinogenic in male and female rats and probably also in mice. In Dr. Rueber's report, he agreed (page 5) that this FDA study (Hansen et al.) must be considered as an acceptable study, and thus the major difference in the conclusions of Dr. Rueber and the authors of this study derives primarily from differences in the interpretation and evaluation of the rat histopathologic data. Dr. Rueber agrees with the authors of the FDA study that 2,4-D was not shown to be carcinogenic in dogs but argues that two years is an insufficient study period to detect carcinogenesis in this species. It should be pointed out that carcinogenic effects have been produced in dogs in studies of less than 2-year duration, and the 2-year period is the recommended exposure period in the current FIFRA guidelines for chronic toxicity studies in dogs. The FIFRA Scientific Advisory Panel recommends that the Agency attempt to resolve the apparent controversy between Dr. Rueber's pathological interpretation of the rat histologic findings and those of the authors of the FDA study before requesting any additional oncogenicity testing in rats with 2,4-D."

EPA has since contracted an additional review of the histopathologic data which did not support these contentions. BLM currently knows of no substantiation for Dr. Rueber's interpretation of these studies.

In a study by Arkhipov et al. (1974), the amino salt of 2,4-D was given to rats and mice with food and by skin painting. The authors of the experiments concluded that there was no demonstrated carcinogenicity of the amino salt of 2,4-D, but that in mice whose skin had previously been painted with a known carcinogen, cocarcinogenic (promoter) activity was observed. However, serious reporting deficiencies in the account of this study make it difficult to assess accurately the conclusions of the authors.

A case-control study (Hardell et al. 1980) examined exposure of workers to phenoxy acids or chlorophenols contaminated by polychlorinated dibenzodioxins (PCDDs) or dibenzofurans (PCDFs), and to a lesser extent organic solvents in men aged 25-85 with a malignant lymphoma who were admitted to the Department of Oncology in Omea, Sweden, from 1974 to 1978. Two controls for each case were chosen based on age, sex, occupation, place of residence, and in the case of deceased, year of death. The authors indicate that there is no decisive proof that malignant lymphoma can be chemically induced. After accounting for congenital factors, induced immunity deficiencies, and known links between benzene and malignant lymphoma, the authors suggest that there may be a relationship between the incidence of malignant lymphoma and exposure to chlorophenols, or phenoxy acids that are contaminated with PCDDs or PCDFs.

In an earlier study (Hardell et al. 1978), all males hospitalized between 1970 and 1977 at the Oncological clinic at Umeaa, Sweden, diagnosed as having soft-tissue tumors were investigated as to occupation, chemical exposure and the other factors. The study indicated that exposure to phenoxyacetic acid (e.g., 2,4,5-T, MCPA and 2,4-D) or chlorophenols contributed to an increased risk from soft-tissue sarcoma, although no evaluation of the effect of specific substances could be made.

A Russian study by Rubenchik et al. (1973) found a carcinogenic effect from diuron, but the work is seriously compromised. The single dose rate of 450 mg/day is higher than the amounts found to cause serious non-carcinogenic pathology. There is no information on the purity of the chemical. The diet was rice, which is low in protein, and otherwise inadequate. The paper gives no information on mortality rates, causes of death, or sex of experimental subjects, all of which are essential. The absence of graded doses is also a serious detriment to the usefulness of the work. Overall, the work cannot be used as an index of carcinogenic activity of diuron.

Most of the chemicals that would be used are characterized by data that is partly or entirely proprietary. All data on 2,4-D and a major portion of data on ammonium sulfamate, diquat, diuron and MSMA are in the open literature, but substantial amounts of data on long established agents such as atrazine, dalapon and picloram are still proprietary. Virtually all data useful in assessing hazard of asulam, dicamba, fosamine, glyphosate, hexazinone and triclopyr are proprietary and available only as brief summaries. EPA, of course, has full access and has evaluated all data in issuing registration.

While none of the chemicals has been shown to be carcinogenic, allegations of such effect have been made. Again, even if such allegations are accepted, the exposure is so limited that the risk associated with either occupational or environmental exposure is so small as to be essentially equal to zero. Therefore, use of tested herbicides at application rates specified on manufacturers' labels poses no significant risk of genetic toxicity to humans.

Table 3-3 Relative Toxicity Levels of Herbicides

Common Name	LD_{50}[1] (in mg/kg)	Commonly Used Terms[2]	Activity in Soil	No-Effect Level Dose (in mg/kg/day)	Tolerances for Residues in or on Foodstuffs (parts per billion)
Ammonium Sulfamate (Ammate)	1,600-3,900	Slightly toxic	Short-term soil sterilant.	Not available	5,000
Asulam (Asulox)	5,000-8,000	Slightly toxic to practically non-toxic	Short persistence; half-life 6 to 14 days.	Not available	100
Atrazine	1,750-3,800	Slightly toxic	Absorbed in muck or clay; remains in upper 1 foot of soil	200 (Reproductive[3])	20-250
Dalapon (Dowpon)	3,860-9,330	Slightly toxic to practically non-toxic	Leaches rapidly in soils; breakdown rapid and complete.	50-150 (Reproductive) 500 (Teratogenic[4])	100-10,000
Dicamba	1,040-2,900	Slightly toxic	Poorly absorbed on soil; short persistence.	3 (Reproductive) 10 (Teratogenic)	50
Diquat	400-440	Moderately toxic	Immediately absorbed and completely inactivated.	Not available	20-100
Diuron (Karmex)	3,400	Slightly toxic	Extensively absorbed, persists from one growing season to the next.	50 (Reproductive) 215 (Teratogenic)	100-2,000
Fosamine (Krenite)	24,000	Relatively harmless	Rapidly inactivated; half-life 6 to 10 days.	60 (Reproductive) 600 (Teratogenic)	None listed
Glyphosate (Roundup)	4,320-4,900	Slightly toxic	Inactivated upon contact with the soil.	30 (Reproductive) 30 (Teratogenic)	100-6,000
Hexazinone (Velpar)	1,690	Slightly toxic	Half-life 1 to 6 months in silt loams.	60 (Reproductive) 300 (Teratogenic)	100-200
MSMA	700-1,800	Slightly toxic	Rapidly inactivated upon contact with soil.	Not available	None listed
Picloram (Tordon)	2,000-8,200	Slightly toxic	Sorption by organic matter and clays; may leach in sandy soils; persistent.	80-150 (Reproductive) 1,000 (Teratogenic)	50-500
Triclopyr (Garlon)	2,140-2,830	Slightly toxic	Possible leaching; half-life of 46 days.	30 (Reproductive) 200 (Teratogenic)	None listed
2,4-D	374-1,980	Moderately toxic to slightly toxic	Leached in sandy soil; breakdown depends on microbial activity.	20 (Reproductive) 20 (Teratogenic)	100-500

[1] Most LD_{50} values are expressed as a range, reflecting the lack of preciseness of experimental data and differences in experimental condition -the type of carrier in which the toxicant is dissolved or the species of test animal used.
[2] Moderately toxic is 50-500 mg/kg; slightly toxic is 500-5,000 mg/kg; practically non-toxic is 5,000-15,000 mg/kg; relatively harmless is more than 15,000 mg/kg in a single oral dose to rats.
3 The highest dosage level at which no reproductive effects have been observed in test animals, including decreased fertility, reduced litter size, reduced offspring size or poor viability.
4 Fetus malformations during development; not associated with genetic change.

Sources: Oregon Weed Control Handbook 1982; USDE BPA 1982, Table 7-7; Dost 1983; 40 CFR 180.

The EPA recently reviewed all available research about potential health effects of 2,4-D. Based on this review, EPA concluded that the continued use of 2,4-D does not pose an imminent hazard or unreasonable adverse effect when used according to label precautions and directions for use (U.S. EPA 1980). EPA has, however, asked manufacturers to conduct more tests to bring the knowledge about 2,4-D up to standards currently required for the registration of new chemicals.

Exposure to chemicals used in forestry applications is possible by occupational and environmental exposures. Occupational exposure occurs to handlers, applicators, crew supervisors and observers at or adjacent to spray units. Mixer/loaders have been found to receive the greatest exposure due to handling of concentrated chemicals. Lavey et al. (1980a, 1980b) found a maximum dose of 0.1 mg/kg of body weight in a mixer/loader as compared to 0.001 mg/kg in observers and crew supervisors. It was also noted that one observer received a dose of 0.05 mg/kg of body weight while assisting with a loader problem.

Backpack applicator exposure to 2,4,5-T during the application process resulted in a direct measured dose of 0.084 mg/kg of body weight (Lavy et al. 1980b). Leng et al. (1982) reported measurements of 0.1 mg/kg and 0.06 mg/kg (body

weight) in two applicators. Nash et al. (1982) reported a maximum individual dose of 0.02 mg/kg/day in a group of 2,4-D applicators.

An observer (occupational) on a landing accidently exposed to herbicide by direct aerial application could receive a dose comparable to a mixer/loader. Chemicals applied at 4 lbs/acre would have a direct deposition rate of 40 mg/ft^2. With 2 square feet of exposed skin area and an absorption rate of 10 percent of the deposition rate, a person directly sprayed could receive a dose as high as 0.16 mg/kg (for a 50 kg person). Wolfe et al. (1976) assembled estimates of respiratory exposure for a variety of pesticides and application modes. In each case, respiratory intake is a very small fraction of dermal intake.

Potential environmental exposures could occur to the general public from drift and accumulated concentrations in ingested water, meat and edible vegetation.

Based on spray drift rates discussed in Chapter 3, Impacts on Water, a person weighing 50 kg (110 lbs) with 2 square feet of exposed skin and an application of 4 pounds of herbicides per acre would receive a dose of 0.002 mg/kg at 100 feet downwind of the spray area. At 500 feet, the same person would receive a dose of 0.0001 mg/kg of body weight and 0.00002 mg/kg at a distance of one-quarter mile from the sprayed unit. Deposition on clothing, unless drenched, would not result in absorption through the skin.

Based on a theoretical expected concentration of 30 parts per billion in a 6-inch stream due to drift at 100 feet, a person (50 kg) consuming 2 liters of the water would receive a dose of 0.0012 mg/kg of body weight. This dosage estimate assumes that the entire amount of water would be consumed at one time and that the normal immediate chemical dilution in the water course would not occur.

Transfer of chemicals through game animals, including fish, has been the subject of many studies. In a study conducted by Dow Chemical, 0.2 mg/kg of body weight (of triclopyr) was given daily to goats for 10 days. Detectable concentrations were found only in the liver (0.004 parts per million) and kidney (0.013 ppm). Muscle tissue contained less than the detection limit of 0.003 ppm. A deer browsing on forage containing the maximum level of 400 ppm would take in a dose of 12 mg/kg. Consumption of 0.5 kg (1.1 lbs) of meat from such an animal would result in a dose of 0.002 mg/kg in a 50 kg person.

Studies by Siltanen and Rosenberg (1978) indicated a 7 ppm residue level on berries (from aerial spraying) while other studies indicated concentrations from zero to 6 ppm. Assuming concentrations of 10 ppm in the treated area, a 50 kg person consuming 0.25 kgs (0.55 lb) of berries would receive a dose of 0.05 mg/kg. The highest concentration measured in mushrooms after aerial applications was 4.5 ppm (Erne and von Haartman 1973), while almost all other measurements were at levels less than 1 ppm.

Application by backpack spraying would result in higher concentrations. Olberg (1973) found immediate residues on wild raspberries ranging from 0.7 to 33 ppm, and Olberg et al. (1974) found 7.9 to 22.2 ppm, which is approximately twice to three times that of aerial applications.

All herbicides proposed for use by BLM are registered with EPA. To be Federally registered, an herbicide must be tested to show that it does not present an unreasonable hazard to health or the environment when used according to the manufacturer's label (40 CFR 162). Even though some herbicides have been used for nearly 40 years, available environmental monitoring studies as reviewed in USDA, FS (1981), USDE, BPA (1982) and Ghassemi, et al. (1981) have indicated that herbicides are not concentrating in humans or in any components of the forest environment. Thus, the EPA- and State-approved labels specifying conditions of use represent the best available guidance for the safe use of herbicides. BLM herbicide application procedures meet or exceed label requirements for safety and protection of the environment.

Public concern about the use of herbicides in forestry resulted in a joint position statement issued in April 1981 by the U.S. Forest Service, Environmental Protection Agency and the U.S. Bureau of Land Management. This statement concluded that, "An assessment of current data on these chemicals (Asulam, Dicamba, Krenite, MSMA, Picloram, Atrazine, 2,4-D and Simazine) coupled with the anticipated exposure indicates no reason to believe that they are posing any unreasonable risk to human health or the environment when used in accordance with the label requirements."

Conclusions

Burning would not be expected to significantly impact human health under any alternative.

Physical injuries such as strains, cuts and fractures would result from treating vegetation with manual and mechanical methods. Based upon

the number of acres treated with manual and/or mechanical methods, injuries would be most likely to occur under Alternatives 3 and 7 and least likely under Alternative 8.

All herbicides proposed for use by BLM in vegetation management have a low order of mammalian toxicity. In general, basic biochemical and physiological differences between plants and animals account for the relatively low toxicity of herbicides to humans. Herbicides are designed to interfere with vital plant processes which are not duplicated in humans.

Extensive studies of the absorption, distribution, metabolism and excretion of herbicides in most animals have shown that herbicides and their metabolites are rapidly eliminated from animals and thus do not accumulate to harmful levels in animal tissues. This reduces the possibility that exposure would result in harmful consequences. All herbicides proposed for use by BLM have a high margin of safety when handled according to label instructions.

Direct exposure of forest workers to herbicides would be most likely under Alternative 6, and progressively less likely under Alternatives 4, 2, 1, 5, 3, 7 and 8. Under Alternative 6, the loss of aerial application would increase use of such equipment as vehicle-mounted sprayers and backpack sprayers. This would maximize workers' exposure via absorption through skin and inhalation of spray mist and vapors. Exposure probabilities under the remaining alternatives would correspond to the number of acres proposed for ground application of herbicides. Indirect exposure of tree planters to herbicides via dermal contact with treated vegetation would be unlikely due to absorption, dilution and degradation rates of herbicides over time prior to the winter planting season.

The probability of the general public being exposed to herbicides would correspond to the number of acres proposed for treatment under each alternative. Exposure would be most likely under Alternative 3, and progressively less likely under Alternatives 2, 1, 5, 4, 6, 7 and 8. The laboratory dosages at which potential reproductive effects have been detected or at which carcinogenic and mutagenic effects have been sought are much greater in concentration and duration than any exposure that would occur in the forest as a result of vegetation control treatments. Because of the limited toxicity of the herbicides proposed for use and the low potential for exposure, the likelihood of an adverse impact on human health is negligible.

Impacts on Economic Conditions

Economic impacts are presented here for two different baselines: as changes measured from the existing condition and as changes expected if the current program direction were continued. The public is generally most concerned with how future conditions would differ from existing conditions. The program manager must know how future conditions would be affected compared to the current program direction. For comparing possible changes in employment and personal earnings, the existing condition is based upon the 1978-1981 average annual harvest from BLM-administered land of 911 million board feet (MMBF). The current program direction baseline (1,207 MMBF per year) represents the allowable harvest levels reported in the western Oregon BLM timber management EISs or decision documents.

Impacts on employment and earnings would be phased in over a period of 2 or 3 years due to the customary time lag between sale and harvest. Table 3-4 projects the average annual employment and earnings potential of timber sales under each alternative. The projections represent the local employment and earnings which would be realized if the annual volume sold under each alternative were promptly harvested and processed.

Table 3-5 focuses on the impacts each alternative would have on public revenue. Under the O&C Act (1937) and subsequent modifications, 50 percent of the receipts from timber sales on revested O&C lands are distributed to designated county governments. The recipients are those counties in which O&C lands are situated, and the basis for distribution is established in the O&C Act (1937). Impacts on receipts would be phased in over a period of 3 or 4 years for a new level of timber sales.

Recently, bid prices for stumpage from the Bureau's western Oregon districts have varied greatly. For example, in FY 1981 the average price of timber sold was $267 per thousand board feet (MBF); however, in FY 1982 these districts recorded an average sale price of $95 per MBF. Because of this variability, Table 3-5 arrays projected distributions of O&C payments to counties based on two possible timber sales price levels. If FY 1982 sales price levels are most representative of the near future, then average annual disbursements to O&C counties from timber sales on the five western Oregon districts are projected to range from $50 million under Alternative 1 to $35 million under Alternative 8. If the higher FY 1981 sales price levels prevail, then Alternative 1 would yield an annual average of

Table 3-4 Impacts Compared to the Existing Conditions and Current Program on Regional Employment and Earnings (Average Annual Amounts) [1]

Change in Employment [2] and Earnings Compared to the Existing Condition (1979-1981)

	Direct Employment					Indirect Employment [2]		Total Employment [2]		Total Personal Earnings [3] ($ millions)	
	Private Sector Employment by Source			Employment in Local Government Dependent on O&C Revenues [3]		Employment Effects in Other Business Sectors					
	Vegetation Control	Tree Planting	Timber Harvest, Processing, and Gross Yarding								
Alt. 1 (Intg. Use)	+91	+32	+1,788	-791	(+1,354)	+1,426	(+3,871)	+2,545	(+7,135)	+49	(+93)
Alt. 2 (Max. Herb.)	+81	+33	+1,801	-789	(+1,359)	+1,436	(+3,885)	+2,561	(+7,159)	+49	(+94)
Alt. 3 (No Burn)	+127	+27	+1,528	-830	(+1,243)	+1,086	(+3,450)	+1,937	(+6,374)	+39	(+83)
Alt. 4 (Lab.-Int.)	+180	+32	+1,781	-792	(+1,327)	+1,498	(+3,912)	+2,697	(+7,232)	+50	(+94)
Alt. 5 (Res. Aerial)	+95	+31	+1,755	-796	(+1,340)	+1,382	(+3,917)	+2,467	(+7,038)	+48	(+92)
Alt. 6 (No Aerial)	+294	+22	+1,372	-854	(+1,137)	+984	(+3,300)	+1,788	(+6,134)	+38	(+78)
Alt. 7 (No Herb.)	+272	-2	+299	-1,018	(+729)	-545	(+1,439)	-992	(+2,725)	-6	(+31)
Alt. 8 (No Action)	-22	-20	-585	-1,150	(-945)	-2,074	(-370)	-3,852	(-853)	-45	(-14)

Change in Employment [2] and Earnings Compared to the Current Program Direction

Alt. 1 (Intg. Use)	0	0	0	0	(0)	0	(0)	0	(0)	0	(0)
Alt. 2 (Max. Herb.)	+10	-1	+13	+2	(+5)	+10	(+14)	+18	(+24)	1	(+1)
Alt. 3 (No Burn)	+36	-6	-260	-40	(-111)	-340	(-421)	-608	(-760)	-9	(-10)
Alt. 4 (Lab.-Int.)	+89	-2	-7	-1	(-27)	+71	(+42)	+152	(+97)	+1	(+1)
Alt. 5 (Res. Aerial)	-4	-1	-33	-5	(-14)	-43	(-53)	-78	(-97)	-1	(-1)
Alt. 6 (No Aerial)	+173	-11	-416	-63	(-177)	-441	(-571)	-757	(-1,021)	-13	(-15)
Alt. 7 (No Herb.)	+181	-35	-1,489	-225	(-633)	-1,970	(-2,435)	-3,537	(-4,410)	-54	(-63)
Alt. 8 (No Action)	-113	-57	-2,373	-359	(-1,009)	-3,500	(-4,241)	-6,397	(-7,788)	-94	(-108)

[1] Modern transportation allows forest workers, logs and chips to be moved economically over long distances. As a result, economic impacts of vegetation management and timber harvest in a particular timbershed are not necessarily concentrated within a particular county or adjoining counties. Therefore, impacts shown in this table are regional and not specific to local areas.
[2] Employment is measured in terms of full-time equivalence, i.e., two jobs of 6-month duration equal one full-time equivalent for the private sector direct employment. Indirect employment refers to jobs.
[3] Based on the average value of timber sold by the Bureau. Estimates in parentheses are based on average timber receipts of $267 per thousand bd. ft.; the estimates without parentheses are based on timber receipts of $95 per thousand bd. ft.

Source: Computations by EIS staff.

$140 million in payments to counties, while Alternative 8 would produce $98 million in disbursements. When compared to the average level of payments made to counties from FY 1979-1981 ($82.98 million), all alternatives would yield lower disbursements if evaluated at FY 1982 sales price levels. Conversely, if projected at FY 1981 sales price levels, all alternatives would increase payments over the annual average distributions from FY 1979-1981. Alternative 2 would yield roughly $80,000 per year more in O&C disbursements than the current program direction at FY 1982 sales price levels. At FY 1981 sales price levels, Alternative 8 would produce $42 million less than the current program direction.

Table 3-6 arrays, by alternative, the annual allowable cut, the cost of vegetation management and the acres of forest land which could be maintained in one of three classes of conifer stocking (see Glossary - Target Stocking). Each of these factors is arrayed at two levels of funding for vegetation management.

Social Environment

BLM's vegetation management program would have direct and indirect impacts on social conditions and attitudes. Direct impacts would occur when some people's sense of personal well-being or economic security is affected by BLM's decisions regarding the use or restriction of particular vegetation management practices. Indirect effects would occur as a result of economic outcomes of BLM policies, and in response to gains or losses of recreational opportunities or access to subsistence activities. Examples of social effects deriving from economic impacts include people's reactions to changes in the availability of different kinds of jobs, their dependence on certain jobs, and the availability of public services. All of these impacts, whether direct or indirect, could affect lifestyle and community stability.

Table 3-5 Projected Distribution of O&C Payments from the Western Oregon SYUs[1] to Counties by Alternative (average annual disbursements in millions of dollars)

O&C Disbursements from SYUs Based on FY 1982 Sales Value of $95 per 1,000 bd. ft.

County	Percent Share of O&C Payment	Alt. 1 (PA)	Alt. 2 (Max. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Benton	2.81	1.40	1.40	1.35	1.40	1.39	1.32	1.13	0.97
Clackamas	5.55	2.78	2.79	2.67	2.74	2.77	2.61	2.24	1.92
Columbia	2.06	1.02	1.03	0.99	1.02	1.02	0.97	0.83	0.71
Coos	5.90	2.94	2.94	2.84	2.93	2.92	2.78	2.38	2.05
Curry	3.65	1.82	1.82	1.76	1.81	1.81	1.72	1.47	1.27
Douglas	25.05	12.46	12.48	12.05	12.45	12.41	11.80	10.09	8.69
Jackson	15.67	7.80	7.81	7.54	7.79	7.76	7.38	6.31	5.43
Josephine	12.08	6.01	6.02	5.81	6.01	5.99	5.69	4.87	4.19
Klamath	2.34	1.16	1.17	1.13	1.16	1.16	1.10	0.94	0.81
Lane	15.27	7.60	7.61	7.35	7.59	7.57	7.19	6.15	5.29
Lincoln	0.36	0.18	0.18	0.17	0.18	0.18	0.17	0.15	0.12
Linn	2.64	1.31	1.32	1.27	1.31	1.31	1.24	1.06	0.92
Marion	1.46	0.73	0.73	0.70	0.73	0.72	0.69	0.59	0.51
Multnomah	1.09	0.54	0.54	0.52	0.54	0.54	0.51	0.44	0.38
Polk	2.16	1.07	1.08	1.04	1.07	1.07	1.02	0.87	0.75
Tillamook	0.56	0.28	0.28	0.27	0.28	0.28	0.26	0.23	0.19
Washington	0.63	0.31	0.31	0.30	0.31	0.31	0.30	0.25	0.22
Yamhill	0.72	0.36	0.36	0.35	0.36	0.36	0.34	0.29	0.25
Total ($)	100	49.76	49.84	48.10	49.71	49.55	47.11	40.29	34.67

O&C Disbursements from SYUs Based on FY 1981 Sales Value of $267 per 1,000 bd. ft.

County	Percent Share of O&C Payment	Alt. 1 (PA)	Alt. 2 (Max. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Benton	2.81	3.93	3.94	3.80	3.93	3.91	3.72	3.18	2.74
Clackamas	5.55	7.76	7.77	7.50	7.75	7.73	7.35	6.28	5.41
Columbia	2.06	2.88	2.89	2.78	2.88	2.87	2.73	2.33	2.01
Coos	5.90	8.25	8.26	7.98	8.24	8.22	7.81	6.68	5.75
Curry	3.65	5.10	5.11	4.93	5.10	5.08	4.83	4.13	3.56
Douglas	25.05	35.03	35.09	33.87	35.00	34.88	33.17	28.37	24.41
Jackson	15.67	21.91	21.95	21.18	21.89	21.82	20.75	17.74	15.27
Josephine	12.08	16.89	16.92	16.33	16.88	16.82	15.99	13.68	11.77
Klamath	2.34	3.27	3.28	3.16	3.27	3.26	3.10	2.65	2.28
Lane	15.27	21.35	21.39	20.64	21.34	21.26	20.22	17.29	14.88
Lincoln	0.36	0.50	0.50	0.49	0.50	0.50	0.48	0.41	0.35
Linn	2.64	3.69	3.70	3.57	3.69	3.68	3.50	2.99	2.57
Marion	1.46	2.04	2.05	1.97	2.04	2.03	1.93	1.65	1.42
Multnomah	1.09	1.52	1.53	1.47	1.52	1.52	1.44	1.23	1.06
Polk	2.16	3.02	3.03	2.92	3.02	3.01	2.86	2.45	2.10
Tillamook	0.56	0.78	0.78	0.76	0.78	0.78	0.74	0.63	0.55
Washington	0.63	0.88	0.88	0.85	0.88	0.88	0.83	0.71	0.61
Yamhill	0.72	1.01	1.01	0.97	1.01	1.00	0.95	0.82	0.70
Total ($)	100.00	139.84	140.07	135.19	139.72	139.26	132.41	113.24	97.45

Change in O&C Disbursements Compared to Existing Conditions (FY 1979-81)

At $ 95 per 1,000 bd.ft.	-33.23	-33.14	-34.88	-33.27	-33.43	-35.87	-42.89	-48.31
At $267 per 1,000 bd. ft.	56.86	57.09	52.21	56.74	56.28	49.42	30.26	14.47

Change in O&C Disbursements Compared to the Current Program Direction (1,213 MM bd. ft.)

At $ 95 per 1,000 bd.ft.	49.76	0.08	-1.65	-0.04	-0.21	-2.64	-9.46	-15.08
At $267 per 1,000 bd. ft.	139.84	0.23	-4.65	-0.12	-0.58	-7.43	-26.60	-42.39

[1] Sustained Yield Units. These are administrative divisions of the EIS area for which timber harvest levels (allowable cuts) are calculated.

Social Dimensions of Employment

The direct economic impacts of the various alternatives on employment and personal income have been discussed in Chapter 3, Economic Conditions. The economic impacts on individuals who obtain or lose jobs would be essentially the same wherever they live. Social effects, however, would depend on whether the jobs gained or lost were concentrated or dispersed, in small or large communities. For example, the gain or loss of 100 jobs scattered around the larger cities in western Oregon would not have significant social effects. In contrast, if those 100 jobs were concentrated in two small towns with a combined work force of 500 employees, there would be significant social impacts on those two communities.

Table 3-6 Impacts of the Alternatives on Allowable Cut, Cost of Vegetation Management and Ability to Achieve Desired Stocking of Conifers

All Feasible Vegetation Mgt. Actions are Funded in an Effort to Maintain Highest Level of Output Output.	Alt. 1 (PA)	Alt. 2. (Max. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Harvest (million bd.ft.)	1,186	1,188	1,146	1,185	1,181	1,122	957	818
Program Cost ($ millions)	12.5	12.1	15.7	13.4	12.5	14.7	14.8	9.2
Achieve Target Stocking (1000 ac.)	1,377	1,392	1,231	1,375	1,357	1,174	813	496
Achieve Minimum Stocking (1000 ac.)	268	253	389	270	284	405	595	730
Below Minimum Stocking (1000 ac.)	0	0	25	0	4	66	237	419
Program Constrained to Level Funded in Alternative 1								
Allowable Harvest (million bd.ft.)	1,186	1,188	1,030	1,148	1,175	983	880	788
Achieve Target Stocking (1000 ac.)	1,377	1,392	904	1,268	1,339	780	630	472
Achieve Minimum Stocking (1000 ac.)	268	253	690	377	302	799	738	749
Below Minimum Stocking (1000 ac.)	0	0	51	0	4	66	277	424

Source: Compiled by EIS staff from BLM district estimates.

Table 3-7 Impacts of Alternatives on Western Oregon Work Force

	Private Sector Employment In Veg. Control and Tree Planting		Private Sector Employment In Timber Harvest and Processing		Total Direct and Indirect Employment	
Alternative	Number	Percent	Number	Percent	Number	Percent
1	+123	+6.8	+1,788	+2.5	+2,545	+0.2
2	+114	+6.3	+1,801	+2.5	+2,561	+0.2
3	+154	+8.6	+1,528	+2.2	+1,937	+0.2
4	+212	+11.8	+1,781	+2.5	+2,697	+0.2
5	+126	+7.0	+1,755	+2.5	+2,467	+0.2
6	+286	+15.9	+1,372	+1.9	+1,788	+0.1
7	+270	+15.0	+299	+0.4	-992	0.0
8	-42	-0.2	-585	-0.8	-3,852	-0.3

Source: Derived from data in Tables 2-6 and 3-4

Social impacts resulting from employment changes can be estimated, but available data do not allow identification of where those impacts would occur. Table 3-7 shows the percentages of the work force (using the 1979-1981 averages from Table 2-6) that would be affected under the various alternatives.

The baseline for the changes in employment in Table 3-4, on which the percentage changes in Table 3-7 are based, is the average employment for 1979-1981. Since those were relatively low employment years, the increases in employment shown for Alternatives 1 through 7 represent re-employment of people in jobs lost during the past several years, not new jobs.

BLM's experience indicates that vegetation management contractors are concentrated in a few smaller cities and that they travel substantial distances to wherever the work is in western Oregon. Because of this concentration and the sizes of the increases in the vegetation management work force (see Columns 1 and 2 of Table 3-7) Alternatives 1 through 7 would probably have beneficial social impacts on those

communities. The small number of vegetation management jobs that would be lost under Alternative 8 would not have significant social effects.

Timber sales, and the harvest and processing jobs associated with any alternative would be widely distributed over the western Oregon districts. Therefore, none of the alternatives would be expected to have significant social impacts resulting from employment changes in timber harvesting and processing or on the total regional employment. The percentage changes are all quite small (see columns 4 and 6 of Table 3-7), and the affected jobs would probably be scattered across the entire region.

Public Services

Revenues paid to the 18 O&C counties affect the availability of public services. The specific services that would be affected cannot be identified since revenue payments based on BLM harvests are not restricted. Assuming that the allowable harvests associated with each alternative are sold and cut, the effects of the alternatives on public services are directly related to harvest level. There would be no significant differences in the public services that could be provided under Alternatives 1 through 6. The greatest difference among these would be 5.9 percent between Alternatives 2 and 6 (calculated using the Allowable Harvest levels shown in Tables 1-2 and 3-6). That amount would be dispersed around 18 counties, and the variation it would cause in public services would not have significant social effects in either a positive (under Alternative 2) or a negative (under Alternative 6) direction. Compared to Alternative 1, the allowable harvest levels for Alternatives 7 and 8 would be 19.3 and 31.0 percent lower, respectively, (again using the figures in Tables 1-2 and 3-6) and would be expected to generate comparably lower revenues. Lower revenues would reduce levels of public services enough to generate significant negative social impacts in most counties.

Attitudes and Opinions

Because of the controversy surrounding the use of hebicides, all alternatives would have social effects related specifically to the herbicide issue. Alternatives 1 through 6 all include the use of chemical methods of vegetation management and would all be perceived as having some degree of adverse impacts on people who oppose chemical methods. These impacts would be greatest under Alternative 3, somewhat less under Alternatives 1 and 2, yet less with Alternatives 4 and 5 and least under Alternative 6. Alternatives 7 and 8 would be perceived as having greatest adverse impacts on those who believe herbicides should be used in forest management.

Some people, particularly residents adjacent to spray units, perceive helicopter spraying as threatening because they associate helicopters with military activities and/or because they feel personally helpless to avoid exposure or to stop spraying in case of unexpected drift or accidental overflight of a nontarget area. They would be adversely affected by Alternatives 1 through 4, which include aerial spraying of herbicides from helicopters. Alternative 5 also includes aerial spraying but would have a lower level of adverse social impacts because of its quarter-mile set-back provisions.

Another category of social effects related specifically to the use of herbicides includes fears and anxieties about human health and personal safety. These concerns would be related to the amount of herbicides used and, therefore, would be greatest under Alternative 3 and progressively less under Alternatives 1, 2, 4, 5 and 6. For some people concerned about this issue, Alternative 7 and 8 would have beneficial impacts.

On the other side of the controversy about chemical herbicides are some people who believe they are safe to use, that the risks associated with their use are acceptable to themselves as individuals and to society at large. For these people, limitations on the use of herbicides could be perceived as threatening to their jobs and lifestyle, and in some larger sense to society as a whole. The threat they perceive to society at large is usually articulated in terms of job losses forcing some people to go on welfare.

Another social impact on attitudes and opinions is related to concerns about smoke from slash burning. The direct impact of smoke is on air quality; the social impact would occur when people respond to deteriorating air quality and their perceptions that poor air quality has negative effects on their communities and lifestyle. People who are concerned about this issue would probably be adversely affected to a similar extent by Alternatives 1, 2, 4, 5, 6 and 7. Alternative 8 would still have adverse impacts, but they would be somewhat less because 25 percent less burning would occur. Alternative 3 would have beneficial impacts on those who are concerned about smoke.

Community Stability

Social impacts on community stability would likely occur if BLM's vegetation management program: 1) caused enough changes (either increases or decreases) in employment to disrupt normal patterns of life in communities where people work and/or where they live; 2) led to attitudes or opinions that increased interpersonal conflict or divisiveness within a community; or 3) caused

anxieties and fears about health and safety that upset people's sense of personal security and social well-being.

None of the alternatives would be expected to cause large enough changes in employment to affect community stability in either positive or negative ways. Simply because vegetation management practices are controversial, all of the alternatives have the potential for causing disruption within or between communities. Such impacts would be most likely under Alternatives 2, 3, 6, 7 and 8, and would be least likely under Alternatives 1, 4 and 5 which include more evenly balanced combinations of vegetation management practices. Alternatives 1, 2 and 3 would be most likely to cause some public concern about human health and safety. This reaction would probably be most intense in areas closest to spray sites but would also appear in more distant areas. In Chapter 2, Social Environment, the number of residences within one-half mile of BLM-administered lands is identified. Only a small percentage of those residences would be near a spray site in any particular year.

The larger metropolitan areas would be little affected in any direct ways by vegetation management practices except burning. Those who are concerned about air quality could be affected enough to organize community opposition to burning. Although there are likely to be people in the metro areas whose perceptions and attitudes would be affected by the various vegetation management practices, the impacts would not be expected to affect community stability.

Local community disruptions as a result of conflicting opinions or incompatible attitudes about resource uses are more likely to occur under the alternatives that strongly emphasize or de-emphasize one particular approach to vegetation management. For example, Alternatives 2, 6, 7 and 8 would be most likely to generate interest and polarized reactions. Alternative 3 could generate an intense response in those communities where smoke management and air quality are sensitive issues. The other alternatives, emphasizing a more balanced and flexible program which could be responsive to local natural and social conditions, could generate some dissatisfaction (because all concerned parties would have to make some compromises), but this dissatisfaction would not likely be intense or particularly devisive.

Conclusions

There will be some unsettling social effects no matter what vegetation management program is followed, simply because the affected public is not homogeneous. Alternatives 2, 3, 6, 7 and 8, which emphasize particular uses or restrictions, are likely to generate some strongly polarized reactions. Alternatives 1, 4 and 5, which incorporate a variety of vegetation management practices in an attempt to respond to a wide range of public attitudes and to ensure the existence of and access to diverse forest uses and values, should generate more constructive social impacts as people debate the issues and find ways to compromise within their communities and with BLM.

List of Agencies, Organizations and Persons to Whom Copies of the Statement are Sent

Public meetings were held in Grants Pass, Medford, Coos Bay, Roseburg, Eugene and Salem, Oregon at which issues and alternatives to be addressed in the EIS were discussed (see Appendix A). In addition, BLM consulted with the Oregon Department of Land Conservation and Development; Oregon State Department of Forestry; USDA-Forest Service, Region 6; and the USDI Regional Solicitor in developing the draft EIS. Comments on the draft EIS were requested from the following:

Federal Agencies

Advisory Council on Historic Preservation
Department of Agriculture
  Forest Service
  Soil Conservation Service
Department of Commerce
  National Marine Fisheries Service
Department of Defense
  U.S. Army Corps of Engineers
Department of the Interior
  Fish and Wildlife Service
  Bureau of Indian Affairs
  Geological Survey
  Bureau of Mines
  Bureau of Reclamation
  National Park Service
Environmental Protection Agency
Small Business Administration

State and Local Government

Oregon State Clearinghouse
Oregon Areawide Clearinghouses (See Appendix G)
Lane Regional Pollution Authority
Oregon Department of Environmental Quality
Oregon Department of Fish & Wildlife
Oregon Department of Forestry
Oregon State Historic Preservation Officer
Boards of County Commissioners
  Benton County
  Clackamas County
  Coos County
  Columbia County
  Curry County
  Douglas County
  Jackson County
  Josephine County
  Klamath County
  Lane County
  Lincoln County
  Linn County
  Marion County
  Multnomah County
  Polk County
  Tillamook County
  Washington County
  Yamhill County

Interest Groups (partial listing)

Audubon Society
Champion International Corp.
FIR
Georgia Pacific
Giustina Bros. Lumber & Plywood Co.
Hoedads
Industrial Forestry Association
International Paper Co.
Izaak Walton League
Klamath Indian Tribe
Menasha Corp.
National Wildlife Federation
Northwest Coalition for Alternatives to Pesticides
Northwest Forest Workers
Northwest Timber Association
Oregon Economic Development Commission
Oregon Environmental Council
Oregon Forest Industries Council
Oregon State University
Oregon Wheat Growers League
Oregon Wilderness Coalition
Oregon Wildlife Federation
Oregon Women for Timber
Oregonians for Food and Shelter
Sierra Club
Siletz Indian Tribe
Society of American Foresters
Southern Oregon Citizens Against Toxic Sprays
University of Oregon
Western Environmental Trade Association
Western Forest Industries Association
Weyerhaeuser Co.
Willamette Industries, Inc.

Copies of this draft EIS will be available for public inspection at the following BLM offices:

Washington Office of Public Affairs
18th and C Streets
Washington, D.C. 20240
Phone (202) 343-5717

Oregon State Public Affairs Office
825 N.E. Multnomah
P. O. Box 2965
Portland, Oregon 97208
Phone (503) 231-6277

Coos Bay District Office
333 54th Street
Coos Bay, Oregon 97420
Phone (503) 269-5880

Eugene District Office
1255 Pearl Street
Eugene, Oregon 97401
Phone (503) 687-6651

Medford District Office
3040 Biddle Road
Medford, Oregon 97501
Phone (503) 776-4174

Roseburg District Office
777 NW Garden Valley Blvd.
Roseburg, Oregon 97470
Phone (503) 672-4491

Salem District Office
1717 Fabry Road S.E.
Salem, Oregon 97302
Phone (503) 399-5646

Reading copies will be placed in the following libraries: Portland State University, Portland; Oregon State University, Corvallis; University of Oregon, Eugene; Lane Community College, Eugene; Umpqua Community College, Roseburg; Linn-Benton Community College, Albany; and public libraries in: Applegate, Bandon, Brookings, Canyonville, Coos Bay, Coquille, Cottage Grove, Drain, Eugene, Gold Beach, Grants Pass, Illinois Valley, Klamath Falls, Medford, Myrtle Creek, North Bend, Oakland, Port Orford, Reedsport, Riddle, Roseburg, Salem, Springfield, Sutherlin, Williams, Winston, and Wolf Creek.

Public meetings will be held on the adequacy, completeness and accuracy of this environmental impact statement. Meetings will be held at the following times and locations:

July 26, 1983, 7:30 p.m., Grants Pass (County Courthouse)
July 27, 1983, 7:30 p.m., Medford (BLM District Office)
July 28, 1983, 7:30 p.m., Eugene (City Council Chambers)

List of Preparers

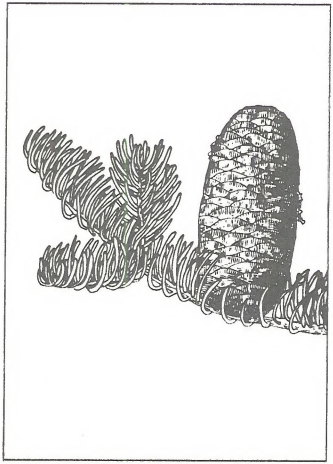
While individuals have primary responsibility for preparing sections of an EIS, the document is an interdisciplinary team effort. In addition, internal review of the document occurs throughout preparation. Specialists at the District and State Office levels of the Bureau both review the analysis and supply information. Contributions by individual preparers may be subject to revision by other BLM specialists and by management during the internal review process.

Name	Responsibility	Primary Discipline	Related Professional Experience
Scott S. Abdon	Recreation	Recreation	9 years BLM (Outdoor Recreation Planner
Dick Bonn	Human Health	Biology	5 years BLM (Environmental Specialist) 11 years SCS (Biologist and Soil Conservationist)
Daniel Bowman	Social Conditions	Social Science	5 years BLM (Archeologist, Social Scientist, Policy Analyst)
James L. Fogg	Water Resources	Hydrology	1 year USFS (Hydrologist) 5 years BLM (Hydrologist)
Charles E. Hawkins	Team Leader	Forest Management	6 years BLM (Forester)
Robert B. Hershey	Description of the Proposed Action and Alternatives, Air Quality Vegetation	Forest Management	13 years BLM (Forester)
Robert House	Fish	Fish Biology	7 years USFWS (Fishery Biologist) 5 years BLM (Fishery Biologist)
Mark Johnson	Geology, Topography, Climate, Soils	Soil Science	4 years BLM (Soil Scientist)
Wayne Logan	Animals	Wildlife Biology	8 years BLM (Wildlife Biologist)
R. Michael Martin	Economics	Economics	6 years (Economist)
Ray Mobley	Visual Resources	Landscape Architecture	5 years BLM (Visual Resources Specialist, Landscape Architect)
Larry R. Scofield	Vegetation	Botany	7 years BLM (Wildlife Biologist, Botanist)
Gary D. Stumpf	Writer Editor, Cultural Resources, ACECs, Special Areas, Wilderness	Archeology	1 year USFS (Archeologist) 5 years BLM (Archeologist)

Other BLM Personnel Contributing Substantial Input

Tom Aufenthie	OSO Technical Coordinator	Forest Development StaffForester	22 years BLM (Forester)
John R. Barnes	Eugene District Technical Coordinator	District Environmental Coordinator	22 Years BLM (Forester, Area Manager)
Jim Batdorff	Coos Bay Technical Coordinator	District Silviculturist	17 years BLM (Forester)
Jesse Higdon	Roseburg District Technical Coordinator	District Silviculturist	22 years BLM (Forester)
Gary Ryan	Medford District Technical Coordinator	District Silviculturist	8 years BLM (Forester)
John Warner	Salem District Technical Coordinator	District Silviculturist	26 years BLM (Forester, Area Mangager)

Appendices



White fir

Appendix A Results of Scoping

Scoping Meetings and Correspondence

Between July 7 and July 15, 1982, public meetings were held in Grants Pass, Medford, Coos Bay, Roseburg, Eugene and Salem to discuss important issues and alternatives that should be addressed in the Western Oregon Vegetation Management Environmental Impact Statement (EIS). Five written statements and letters were also received during or following these meetings.

Alternatives

During these meetings, 19 alternatives were proposed for consideration in the EIS. Following is a summary of these alternatives, designated A through S, and BLM's analysis of their usefulness and relevance to the EIS process.

A. Utilize "Competing" or "Unwanted" Vegetation
This would more correctly be classified as an issue than an alternative. It emphasizes use of the by-products of most treatments but does not in itself represent an alternative treatment. Under all alternatives, efforts will be made to use competing vegetation where markets for it exist.

B. Use Less Herbicides and Increase Development of Other Practices, Particularly Labor-Intensive
This alternative would reduce herbicide use from present levels and provide opportunities to develop alternative methods. It addresses a relevant and important issue which can be evaluated in the EIS.

C. Emphasize Stewardship Contracts in Managing Competing Vegetation
This does not represent an alternative treatment or set of management practices which could be analyzed in the EIS. It refers to a contracting technique which could be considered for use under most alternatives. The viability of stewardship contracting is currently under study by BLM.

D. Emphasize Preventive Treatments
Discussion on this alternative favored the use of harvest and site preparation practices which would result in the fewest vegetation management problems. Such practices would be included as design features under all alternatives and used whenever feasible. They would not compose a separate alternative.

E. Use Integrated Pest Management
This was proposed several times and was often defined differently. All discussions supported a balance of different methods of vegetation control versus a dependence on herbicides. There was also some emphasis on insuring that vegetation is actually a pest (i.e., competing) before it is treated. This concept is consistent with Department of Interior policy.

F. No Aerial Spraying
This proposal would eliminate all aerial application of herbicides. It is a relevant alternative which can be evaluated.

G. Treat Vegetation Management as a Thinning Project
This alternative focused on manually cutting competing vegetation as one would selectively thin a stand during precommercial thinning. This "thinning" treatment would only be appropriate for a relatively brief period in the life of a stand and would not represent a viable alternative during a stand's early stages of growth. Manual cutting of competing vegetation is included under Alternative B.

H. Use Slash as an Alternative Energy Source
This proposal is an element of Alternative A.

I. Harvest Medicinal Plants
This proposal is an element of Alternative A.

J. Emphasize Labor-Intensive Practices (assume current budget)
The labor-intensive concept is included under Alternative B. Using our current budget as a constraint would prevent us from meeting allowable cut levels specified in existing and proposed BLM district timber management plans. In order to be consistent with those plans, funding levels will be allowed to fluctuate between alternatives. The changes in allowable cut that would result from restricted funding will, however, be identified for each alternative.

K. Use Harvest Practices Which Reduce Future Problems
This concept is an element of Alternative D.

L. Use More Conservative Approach When Bordering Private Land
This represents a variation of Alternative F, excluding aerial spraying only within a given distance from private land. It addresses a relevant issue.

M. While Operating Within State/Federal Law, Operate to Maximize Return on Investment (With Regard to Final Crop)
The first part of this proposal calls for only the minimum environmental safeguards provided under State and Federal law. An example appropriate to this EIS would be the use of less restrictive Forest Practices Act stream buffers in lieu of current BLM standards. This concept will be analyzed in an alternative which provides for the maximum use of herbicides. The remainder of the proposal focuses on economic efficiency, which will be analyzed for each alternative.

N. Optimize Mix of Labor-Intensive vs. Other Methods to Maximize Jobs Through Life of Stand
This concept is an element of Alternative B.

O. Provide a Given Percentage of Available Budget for Vegetation Management
See discussion of Alternative J.

P. Do Not Use Herbicides
This alternative eliminates the use of all herbicides for vegetation management, relying totally on other methods. It is a relevant alternative.

Q. Use Full Resource Analysis
This is an issue rather than an alternative. The intent behind the proposal was to ensure that treatment needs would be fully analyzed. This would presumably reduce the need for brush control, reduce herbicide use and minimize risks to humans and the environment. A full analysis of treatment needs and resource impacts will be included as a design feature under all alternatives.

R. Use Full Economic Analysis
This proposal represents an effort to evaluate all costs to BLM; direct and indirect, short-term and long-term. An economic analysis will be part of each alternative but will not constitute a separate alternative.

S. Fully Mitigate Impacts
This proposal would select methods that would minimize disruptions to the environment. It corresponds to the "no action" alternative which will be analyzed in the EIS.

Alternatives Selected

The following alternatives were selected for analysis in the EIS as a result of the scoping process:

Alternative 1 (E): Proposed Action
Alternative 2 (M): Maximum Effective Use of Herbicides
Alternative 3: Use of All Vegetation Management Treatments Except Burning
Alternative 4 (B, J and N combined): Emphasis on Use of Effective Labor-Intensive Methods
Alternative 5 (L): Restricted Aerial Application of Herbicides
Alternative 6 (F): Use of All Vegetation Management Treatments Except the Aerial Application of Herbicides
Alternative 7 (P): Use of All Vegetation Management Treatments Except the Application of Herbicides
Alternative 8 (S): No Management of Competing Vegetation

The use of 2,4,5-T or Silvex will not be incorporated into any alternative unless they are authorized for forestry uses by EPA.

Issues and Concerns Addressed

Attendees at the public scoping meetings were asked to suggest issues and concerns that should be addressed in the EIS. Issues which were relevant to the scope of the EIS and were included in the analysis are listed below.

Air Quality
Burning slash may cause smoke intrusions.

Soils
Vegetation management practices may increase erosion, deplete soil nutrients and adversely affect beneficial microorganisms in soil.

Water
Herbicides may contaminate streams.
Sedimentation may increase.
Stream buffers should be maintained.
What are the long-term effects of chemicals on groundwater?
Evaluate the persistence of herbicides in the environment.

Vegetation
Herbicide spray may drift over nontarget areas.
Effectiveness of spray should be monitored.
Maintenance of plant species diversity.
Will conifers be damaged by chemicals?

Fish/Wildlife
Maintenance of adequate habitat, forage and species diversity.

Social Conditions
Local residents should be notified of BLM operations.
2,4,5-T should not be evaluated.
Public should have opportunity to influence policy.
Past public input should be used.
Data gaps should be discussed in EIS.
Don't use aerial spray near residences or water sources.
Emphasize labor-intensive methods to develop a work force.
Do not use aerial spray.
Generate more employment opportunities.
Consider side effects on unemployment, welfare, etc.
Existing controversy should be disclosed.

Economic Conditions
How will vegetation management practices affect timber yield projections?
Examine conflict between forest as "money producer" and forest as "environment".
Analyze total costs, including repeat treatments.
Economics of various alternatives should be analyzed.

Human Health
Should 2,4,5-T be used at all?
Consider effects of practices on health in general.
Do threshold levels really exist below which exposure to herbicides is safe?
Examine claims that dioxin can cause health problems.
Examine conflicting evidence concerning safety of herbicides.
Discuss comparative degrees of toxicity.
Woods workers are concerned about exposure when working in recently sprayed units.

Ecological
Discuss ecosystem disruptions which might result from managing competing vegetation.

Other
Can toxicological documentation be made available as part of draft EIS?
How do we define vegetation management problems?
Evaluate effects of spray "carriers" (i.e., diesel oil).
BLM should define goals more precisely.

Issues and Concerns not Addressed

The following issues raised by the public were not addressed in the EIS for the reasons identified.

Issues not addressed because they represented opinions rather than environmental issues that could be analyzed:
Forest by-products should be utilized, not wasted.
It is not feasible to immediately use 100 percent labor-intensive methods. Phase them in gradually.
Some "benefits" of vegetation management practices are questionable.
Breadth of scientific expertise on the EIS team is limited.

Issues not addressed because they were not environmental issues that could be analyzed or were outside the scope of this EIS:
There should be better record keeping and notification by adjacent private landowners who spray.
How will we handle differences of opinion?
Can BLM do more research on alternatives?
How to get 2,4,5-T back for forest use.
Analyze where BLM expenditures go--to local economy or elsewhere.

Issues not addressed because there were no identified impacts:
Discuss synergistic effects of herbicides.
What is the significance of bio-accumulation and unrepaired cellular damage?
Harvesting medicinal plants which are competitive instead of killing them.
Will BLM slash burning increase fire risk?

Issues not addressed because they represent preferences about the conduct of the program that are applicable to all alternatives:
The public should participate in site evaluations.
Collect more centralized information on herbicide use patterns on intermingled public and private lands.
Public should have more input to design of tests and checking of test results.
BLM should have flexibility to negotiate with residents.
Adjacent residents should be treated with respect and sensitivity.

Issues to be considered in the decision process:
Streamside sediment should be monitored for chemicals.
Spray effects on wildlife should be monitored.
Will vegetation management practices affect adjacent agriculture?

Miscellaneous issues not addressed and the rationale for not addressing them:
Consider implications of serious economic decline on the vegetation management program: This was not analyzed because it would not vary by alternative, and therefore an analysis would not provide meaningful information to the decisionmaker. Social opportunity costs, such as costs that would result from not employing people under some alternatives, could not be specifically identified for analysis.

Analyze hidden costs: Costs which were one-time fixed costs rather than direct costs of the annual program were not included because they were outside the scope of the economic analysis, which was limited to an annual program.

BLM should monitor local health conditions, allergy cases and effects of spray on mother's milk: BLM does not have the organization or the expertise to monitor such conditions, and the issue is outside the scope of the EIS.

Discuss status of pesticide registration, the registration process, re-registration and conditional registration: Discussion of EPA registration is outside the scope of an EIS.

Appendix B Analysis of Program Costs

Program costs were analyzed to provide a monetary basis for comparing the alternatives. During calendar year 1982, in response to a report by the U.S. General Accounting Office (U.S. GAO 1981), each western Oregon BLM district recorded detailed project cost data on all vegetation management activities. The completed project cost data sheets were the primary sources of current BLM costs used in this EIS. They included direct contract costs and indirect costs of project layout, contract preparation, contract administration, public notification, water sampling and analysis of water samples. Costs associated with EIS preparation, litigation, accidents and training were not included.

The ranges of actual treatment costs per acre are summarized below. The ranges primarily reflect differences in costs between districts due to differences in terrain, chemicals, application rates, unit size, types of vegetation treated and other local factors. For example, average scarification costs vary from $116 in Roseburg District to $235 in Salem District.

Each district applied the appropriate costs to their treatment acres to determine total program costs. For the unconstrained budget analysis, districts budgeted whatever was necessary to carry out their proposed programs. For the constrained budget analysis, total dollars were limited to the level needed to fund Alternative 1, and treatments were eliminated until the remaining program could be carried out with the funding available. In most cases, precommercial thinning and release treatments were the first practices eliminated under the constrained budget, insuring that maintenance (survival) programs would be funded. In a few cases, gross yarding was reduced, and affected acres were maintained at minimum stocking levels.

Extra costs would be incurred under some alternatives due to the use of less effective practices such as manual cutting. These costs are reflected in terms of increased acres treated and are thus included in the total program costs.

Individual Treatment Costs Per Acre for Western Oregon BLM Districts

Site Preparation		Maintenance and Release	
Treatment	**Costs Per Acre($)**	**Treatment**	**Costs Per Acre($)**
Mechanical		Manual	
Scarification/Piling	116-235	Slashing	100-135
Gross Yarding	300-600	Mulching	220
Hydro-axe	101-180	Pulling	46-105
Manual		Chemical	
Slashing	96-180	Aerial	40-95
Spot Clearing/Scalping/Hand Piling	50-250	Ground	45-160
		PCT	77-80
Chemical		Biological	
Aerial	40-130	Seeding	25-150
Ground	36-165	Animals	10
Burning	150-363	Roadside Maint.	
		Mechanical	114-155
		Manual	109-181
		Chemical	71-110

Appendix C Assumptions and Guidelines Used to Estimate the Annual Vegetation Management Program Levels and Associated Allowable Harvests

The annual treatment acreages proposed under this program (See Table 1-2) were estimated separately by each western Oregon district utilizing the professional knowledge and experience of those most familiar with the vegetation management program. Each district also estimated the number of acres that could not be reforested within 5 years of harvest or that would only meet minimum stocking standards if certain treatments were not available for use. These estimates were used to determine allowable harvests under each alternative. The following guidelines were used in developing the estimates.

General

1. Assume unlimited funding. The dollars needed to carry out the program would be available under each alternative.

2. The levels of stocking and allowable harvest described in each district timber management EIS preferred alternative or decision documents would be the goal under each alternative in the vegetation management EIS.

3. Planting sites would be prepared, using the treatments available under specific alternatives, to as nearly the same degree as possible.

4. Treatments used should be effective and reasonable. They must be proven by research or field experience or must show promise of effectiveness based on current research efforts. Availability of manpower and equipment to carry out the program should be considered in determining whether a treatment is reasonable.

5. Treatments must achieve the Bureau's target or minimum stocking level within 5 years of harvest, or the allowable harvest must be adjusted to reflect the reduced land base.

6. When the number of retreatments required for effectiveness is unknown, each district should limit the number to the same number of herbicide treatments it has had to apply on difficult areas (i.e., 2 or 3 treatments).

7. The existing program is generally based on an annual average for the 1979-1982 period.

Specific Guidelines by Alternative

1. Alternative 1 (Proposed Action):
The starting point for the vegetation management program would be based upon levels identified in the district timber management EIS preferred alternatives or in decision documents. These levels could be increased if the districts felt they were too low.

2. Alternative 2 (Max. Herbicide): Manual, mechanical and biological treatments would be reduced where herbicides would meet program objectives. Chemical PCT would be used where desired.

3. Alternative 3 (No Burn): An increase would be expected in one or more of the following treatments: gross yarding, hand piling, cutting holes in slash, herbicide application, scarification, machine piling, planting larger stock and protecting seedlings.

4. Alternative 4 (Labor-Intensive): Replace mechanical and aerial methods with manual methods (slashing, scalping, piling, spraying, etc.) where they would be effective. Don't strive to maximize labor if treatments would not be effective. Where there is more than one manual treatment that would work, use the least costly treatment.

5. Alternative 5 (Restricted Aerial): Treatments other than aerial spraying would be allowed within the one-quarter-mile corridor.

6. Alternative 6 (No Aerial): Increases would be expected in ground spraying, other manual treatments, mechanical treatments or biological treatments.

7. Alternative 7 (No Herbicide): Increases would be expected in manual, mechanical and biological treatments.

8. Alternative 8 (No Action): Only use those site preparation practices necessary to provide access for planting and to prepare planting sites (i.e., burning, gross yarding, slashing).

In order to demonstrate budget effects on each alternative, each district also evaluated the effect of a constrained budget at the unconstrained dollar level of Alternative 1. The districts attempted to maintain the highest possible harvest level under the limited budget. Sacrificing intermediate harvests at the expense of assuring a full final harvest was acceptable, so precommercial thinning and release treatments were dropped when necessary to insure survival of the minimum stocking. In some cases, gross yarding was decreased to reduce dollar expenditures, and the affected acres were assumed to meet only minimum stocking standards.

Appendix D Excerpts from *Field Guide to Policies and Procedures Required for Vegetation Management with Herbicides in Western Oregon* (USDI, BLM 1981a)

Pre-Treatment Surveys

Documentation of the following information is required as a minimum when conducting pre-treatment vegetation management field surveys:

1. Management program/objective for the site.
2. Consideration of all feasible vegetation management alternatives.

a) Identification of environmental effects of each alternative - fish, wildlife, soil, water, air, rare/endangered plants and animals.
b) Human safety associated with each method.
c) Effectiveness of each method (retreatment needs).
d) Cost of each method (Ref. Inst. Memo 81-595).
e) Specificity of each method—hazard to non-target species.
f) Map of survey unit(s).

3. Recommended treatment method(s) (combinations).
4. If chemical pesticides are recommended, the following additional information is required.

a) Herbicide, application rate, carrier.
b) Posting requirements.
c) Positive placement techniques planned to minimize drift and effects on non-target areas.
d) Method of application.
e) Special restrictions on the herbicide label with regard to handling, buffer strips, grazing, planting, wind speed, droplet size, etc.
f) Monitoring needs (water).

Project Design Features

Buffer Strips

The following are minimum widths (measured horizontally) for protective buffer strips for all herbicides applied adjacent to live streams, lakes or ponds. Wider buffers should be used if required on the labeling of the herbicide planned for use.

Method	Buffer Strip
Aerial Spraying	100 feet
Vehicle Spraying	25 feet
Hand Application	10 feet

Aerial applications require that a 500-foot unsprayed buffer strip will be left adjacent to inhabited dwellings unless waived, in writing, by the resident. A buffer strip of at least 100 feet will be left adjacent to land used for pasture, crop land, dwellings or barns.

Posting of Spray Areas

Install temporary project area signs at points of common public access that identify the herbicide used, date applied and purpose and telephone number of the local BLM office. These signs shall be in English and Spanish. Certain restricted use pesticides may require posting additional information described on the label as a condition of use.

Posting of areas treated with non-restricted pesticides is not required where the local manager judges there is no likelihood of public exposure.

Application Contract Requirements

Most of the herbicides used in western Oregon are applied through contracts awarded to the lowest bidder. The contractor normally supplies and applies the herbicides.

1. Contracts for application will require that the water intake system for mixing shall be arranged so that an air gap or reservoir will be placed between the live water intake and the mixing tank to prevent any backflow of chemical into the water source.

2. Contracts for application will require that contractors will not wash out any spray tanks in or near any streams or dispose of any chemical containers on the contract area. Chemical containers should be disposed of at Department of Environmental Quality approved sites.

3. During aerial spraying, spray will be turned off at the end of spray runs and during the time when a turn is being made to start another spray run. Initial spray swaths along buffer strips or areas to be protected will be made parallel to these areas and before spraying commences on the rest of the project.

4. Mixing and loading operations will take place in an area where an accidental spill will not flow into a stream or body of water.

5. Applications to asphalt or other types of paved roads will be avoided.

6. Aerial application equipment will be equipped with no drip nozzles that use a vacuum or syphon automatic shut off system that will draw the chemical back from the boom when not spraying. Spray nozzles on the boom will not be extended horizontally on the boom to more than 6/7 of the length of the helicopter rotor.

7. In aerial applications, the contractor shall provide at least one qualified individual for each mixing truck to handle fueling, mixing spray solutions and loading. He shall also provide a foreman for each heliport to supervise operations. The foreman shall be equipped and trained to take remedial action in the event of equipment malfunction or spills of herbicide or herbicide carrier mixes.

8. To minimize drift and volatilization, aerial spraying operations will usually be prohibited when any of the following conditions exist on the spray area: wind velocity exceeds 5 miles per hour; temperature exceeds 70° F; snow or ice covers vegetation; raining or rain expected that will reduce the effectiveness of the chemical being applied; foggy weather; relative humidity is less than 50 percent and temperature exceeds 70° F (applies to water based sprays only); air turbulence (thermal up drafts, etc.) is so great as to seriously affect the normal spray pattern; temperature inversions are present which could lead to off-site movement of the spray.

Label directions will be followed in lieu of the above if they prescribe different conditions of use. Low volatile formulations of phenoxy herbicides will be used to reduce the potential for off-site contamination.

9. Hourly measurements of weather conditions will be made by trained personnel at spray sites during application. Additional measurements will be made anytime it appears that a weather change may be taking place that could jeopardize safe placement of the spray on the target area.

10. Helicopters will normally be required to fly at an air speed of 40 to 50 mph at a safe distance above the vegetation. Spray pressure in the boom will normally be 20 to 35 pounds per square inch. Maximum drift reduction with normal spray formulations and application equipment will be used.

Specific herbicide labels may specify boom pressures, air speeds, aircraft heights and nozzle configurations that are considered desirable to reduce drift and increase effectiveness. In the event of a conflict, the label specifications will be followed in lieu of the aforementioned requirements.

11. During air operations a radio network will be maintained which links all parts of the project. Direct radio communications between spray aircraft and ground crews will be established.

12. Pre-spray reconnaissance flights will be made to orient pilots to project area boundaries and any sensitive areas such as agricultural lands, important streams, residences, and fish hatcheries that are near spray target areas.

13. On herbicide application projects conducted directly by Bureau personnel, a licensed (certified) employee will monitor and supervise the project. Contractors will be licensed according to State and Federal law. Compliance with contract requirements will be enforced by a BLM project inspector.

14. Buffer strips (or no spray areas) may be designated by the Contracting Officer's Authorized Representative (COAR) or the project inspector during operations as a means to protect heretofore undetected rare plants, critical riparian zones and other sensitive areas.

Monitoring

A water monitoring program will be carried out by each district as part of the proposed action. The purpose is to determine the effectiveness of buffer strips, and administrative controls in minimizing impacts on water quality and the aquatic environment.

Deep well water monitoring will be done upon request if there is a reasonable expectation that there is potential for contamination from BLM spray operations. Expertise from EPA, Oregon Universities, and the State Department of Agriculture will be consulted if a monitoring request is received to ascertain whether such requests have any validity.

Each District will evaluate its monitoring needs. At the time the annual spray program is developed, the District should determine the location of Class I streams and those areas which might require special attention such as domestic water supplies and fish hatcheries.

This information will be used in establishing priority sampling areas. When reviewing the locations of planned herbicide treatments, the District person responsible for water quality monitoring will select sample sites for water quality samples.

Monitoring schedules will be designed to sample during periods when any contamination will be most detectable. Contingency plans should be developed to permit sampling during any phase of the treatment program should a situation arise when quick reaction is needed. Control samples will be taken prior to treatment. Ideally, this should be within 24 hours of the treatment period. The sample should be taken from the same site as the other monitoring samples.

Selection of Monitoring Streams and Stations

Any stream may be considered for water quality sampling. However, it is neither possible nor necessary to sample all waters. To aid in selecting streams for monitoring, a priority system has been developed. Highest priority will be given to those streams with important fisheries, extensive human use, or where the potential exists for major environmental impacts. The following is a list of priorities for which monitoring is required:

1. Municipal Watershed
Sampling will be done on streams contributing a major portion of a municipal water supply if: a) the spray project is adjacent to a stream; and b) the diversion point for the municipal water supply is not more than 10 miles downstream from the treatment area. Sample sites will be established just below the treatment area and just above the municipal water diversion point.

2. Fish Hatchery Supply Watershed
Sampling will be done on streams providing water for fish hatcheries if the fish hatchery is less than 10 miles downstream from the treatment area. Sample sites will be established just below the treatment area and just above the hatchery diversion point.

3. Domestic and Agricultural Watershed
Agricultural uses include irrigation and livestock uses. Streams for domestic and agricultural water supplies will be sampled if the diversion point is one mile or less downstream from the treatment area. One sample site will be established below the boundary of the treatment area.

4. Major Fish-bearing Stream
Major fish-bearing streams are those identified by District Biologists as Class I streams. Sampling will be done on all Class I streams at sites located downstream from the treatment area.

5. Unique Situations
In addition to the above situations where monitoring is required, monitoring should also be considered on an individual basis in a number of other situations:

a) The stream is not classified as a Class I stream but contains an important population of resident fish.

b) The stream flows into a marsh or lake which is located within five miles downstream from the treatment area. Herbicide dissipates gradually in flowing water but will accumulate in quiet areas such as lakes or marshes. In the lakes or marshes, the herbicide can affect rooted or planktonic flora.

c) Thirty percent or more of a watershed is being treated in one year. This is especially important during the winter and spring months when many of the smaller ephemeral and intermittent streams are flowing. Any herbicide entering a smaller stream will be quickly diluted when the smaller stream merges with other streams. If several areas in a watershed are treated, the dilution effect may be lost. In watersheds with extensive herbicide treatment, where the dilution effect may be reduced, sampling should be considered, at least on the larger streams downstream from the treatment area.

d) The watershed is considered to be socially sensitive. Public interest is often much greater in some areas than others. Those areas for which the public has expressed the most interest should be considered for water quality monitoring.

Appendix E Excerpts from *Field Guide to Oregon Forest Practice Rules* (OSDF 1980)

General Rules

629-24-101 Definitions. As used in these rules, unless otherwise required by context:

"Class I streams" means waters which are valuable for domestic use, are important for angling or other recreation, and/or used by significant numbers of fish for spawning, rearing, or migration routes. Stream flows may be either perennial or intermittent during parts of the year.

"Class II streams" means any headwater streams or minor drainages that generally have limited or no direct value for angling or other recreation. They are used by only a few, if any, fish for spawning or rearing. Their principal value lies in their influence on water quality or quantity downstream in Class I waters. Stream flow may be either perennial or intermittent.

"Buffer strip" means a protective area adjacent to an area requiring special attention or protection.

Application of Chemicals

629-24-203 Protection of Waterways, Areas of Open Water, and Dwellings when Spraying. Protect waterways and areas of open water such as swamps or impoundments from contamination when spraying by aircraft by leaving a buffer strip of at least one swath width untreated on each side of every Class I stream or area of open water. When applying 2,4,5-T or silvex, maintain a 200 foot buffer strip around Class I streams or areas of open water. Maintain a 500 foot buffer strip around inhabited dwellings unless written permission is received from the resident. When applying spray from the ground, leave unsprayed a buffer strip of at least ten (10) feet on each side of every waterway or area of open water. Spray application immediately adjacent to buffer strips shall be made parallel to waterways, and must be applied prior to application to the remainder of the area to be treated. No buffer strip is required in the application of fertilizers except that precautions shall be taken to avoid direct application of fertilizers to Class I streams or areas of open water.

Appendix F General Descriptions and Summaries of Fates and Impacts of Chemicals Proposed for Use

The following descriptions were adapted from Ghassemi et al. (1981); USDA, FS (1981); USDE, BPA (1982) and Dost (1983). For more detailed information, refer to those source documents.

Chemicals Described **Page**

Ammonium Sulfamate 84

Asulam 84

Atrazine 85

Dalapon 87

Dicamba 89

Diquat 91

Diuron 91

Fosamine Ammonium 93

Glyphosate 95

Hexazinone 97

MSMA 99

Picloram 100

Triclopyr 103

2,4-D 105

Diesel Oil 109

Common Name: Ammonium Sulfamate (AMS)

Chemical Name: Ammonium sulfamate

Major Trade Names: Ammate X-NI

Major Applications in Forestry: Used to control annual and perennial herbaceous plants. Current BLM use is poison oak control on recreation sites.

Summary

Ammonium sulfamate is not retained in soil but moves with soil moisture. Breakdown produces sulfates and nitrates which act as plant nutrients. Inhibition of weed seed germination disappears after 6 to 8 weeks.

Fate in water has not been reported, but due to its high water solubility, it would be rapidly diluted. Ammate X-NI is designed specifically for controlling undesirable vegetation growing adjacent to domestic water reservoirs, streams, lakes and ponds.

Toxicity

Ammonium sulfamate is classed as only a slightly toxic chemical in animals and humans. Neither skin irritation nor systemic toxicity of any significance have been observed. It has a low order of toxicity to fish and wildlife. No evidence of carcinogenic, mutagenic or teratogenic activity has been obtained.

Hazard Assessment

Ammonium sulfamate is an effective contact herbicide, and spray drift will injure the fruit or foliage of nontarget species. Such damage will be limited by the degree of exposure, environmental conditions (particularly temperature and the amount of moisture) and the innate sensitivity of the species.

Based upon studies of rodents, birds, fish and livestock, a low order of toxicity would be expected. AMS (30 ppm) applied to the head of an artificial stream had no effect on the aquatic community composed of bottom-dwelling and drifting invertebrates and rainbow trout. Body weight gain, general condition, and fertility of quail were not affected by feeding an AMS dosage of 150 mg/kg/day. Likewise, no adverse effects were reported in cattle and sheep fed AMS or diets containing AMS in high amounts.

Detailed information, summarized above, concerning the fate and behavior of ammonium sulfamate in the environment and potential impacts may be found in the source document USDE, BPA (1982). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference.

Common Name: Asulam

Chemical Name: Methyl sulfanilylcarbamate

Major Trade Names: Asulox

Major Applications in Forestry: Used for site preparation, maintenance and release to control bracken fern.

Summary

Asulam is rapidly mobile in soil and can be expected to leach down the soil profile into the drainage water. Breakdown of asulam is temperature-dependent, more rapid breakdown occurring when temperatures are higher. Degradation is rapid in topsoils and slow in subsoils. Asulam is not adsorbed to any marked extent by soils at pH above 4.5.

Toxicity

Acute and chronic toxicities are of low order to all species tested (mammals, birds and fish), and asulam is not accumulated in fish. No evidence of teratogenicity or mutagenicity was found.

Hazard Assessment

Noble fir may be sensitive to the highest rates recommended for bracken fern control. Based upon studies of mammals, birds and fish, a low order of toxicity would be expected. Asulam is registered throughout the world for use in pastures and other noncrop areas.

Detailed information, summarized above, concerning the fate and behavior of asulam in the environment and potential impacts may be found in the source document USDA, FS (1981). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. In the Oregon Weed Control Handbook (1982), asulox is recommended for noncrop land, reforestation sites and Christmas tree plantations only.

Common Name: Atrazine

Chemical Name: 2-chloro-4-ethylamino-6-isopropylamino-s-triazine

Major Trade Names: AAtrex (80W, 90W, 4L, 4CL)

Major Applications in Forestry: Used primarily in the Pacific Northwest in conifer site preparation, maintenance and release for grass and broadleaf weed control.

Summary

Most of the available information on the fate of atrazine in soil and water is the result of laboratory and/or field studies with agricultural systems. Very little data are available on or in connection with applications to forests.

Atrazine is considered a stable, persistent herbicide and may persist in phytotoxic concentrations for over a year in agricultural soils. High concentrations of soil organic matter, such as may be present in forest soils, as well as low temperatures, tend to increase its persistence. Atrazine degrades via chemical and microbial routes; the extent of and factors affecting such degradation in forest soils have not been fully investigated. The extent of atrazine losses due to volatilization from agricultural soils is very small. Such losses are expected to be even less from forest soils due to lower temperatures. Atrazine decomposes by UV light; the extent of photodecomposition in forest systems is expected to be very low.

Atrazine is considered a low mobility herbicide. Leaching and desorption of atrazine are lowest in soils with high organic matter content, and hence should be low in forest soils. Atrazine is slightly soluble in water. It has been measured in rivers near application sites following heavy rainfalls. Atrazine degrades to some extent in water.

Atrazine is phytotoxic to numerous nontarget plant species. It is extremely toxic to very young, recently-emerged red and white pine seedlings. Atrazine is only slightly toxic to fish, moderately toxic to lower aquatic organisms, and reportedly has no insecticidal activity. It is relatively nontoxic to mammals. Bioaccumulation is low in fish, moderate in microorganisms, and nil in animals. Carcinogenicity and teratogenicity have not been detected at test dosages. Limited mutagenic properties have been found in fruit flies and plants but not in several other test systems.

Inert ingredients present in atrazine formulations are not considered hazardous. Detailed information, summarized above, concerning the fate and behaviour of atrazine in the environment and potential impacts may be found in the source documents, Ghassemi et al. (1981); USDA, FS (1981); and USDE, BPA (1982). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 23-25 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

The reproductive no-effect level for single doses is at least 20 mg/kg. However, because some other biochemical effects can be detected in rats at about 50 mg/kg, that figure is taken as the no-observed-effect dose.

Atrazine is at worst a very weak mutagen, causing some detectable chromosomal damage in fruit fly larvae at the highest level found to be nonlethal (Murnik and Nash 1977). It does not cause point mutations (Anderson et al. 1972; Siebert and Lemperle 1974; Plewa and Gentile 1976; Seiler 1973). Atrazine has been alleged to cause formation of a mutagenic metabolite in young corn plants, but that effect is caused by the extract of both untreated and treated plants if they are well nourished. Atrazine may be considered to represent no mutagenic hazard.

Studies so far conducted have detected no carcinogenic potential for atrazine. A lifetime intake by mice of 83 ppm (estimated at about 17 mg/kg/day) caused no increased incidence of tumors. The manufacturer has recently completed studies in other species with a similar outcome. The metabolic pattern and mutagenicity studies also suggest an absence of such activity. In absence of suggested or demonstrated carcinogenic activity, atrazine must be considered to not represent a carcinogenic risk.

Hazard Assessment

Atrazine is applied primarily to control grass and is absorbed through the root system. It is relatively insoluble, and when the suspending aqueous carrier evaporates, any solid material that remains on foliage surfaces can be washed off by rain or dislodged by traffic.

Applicator exposure is not readily measurable. Dermal absorption apparently is poor, as evidenced by the very limited acute dermal toxicity. (The dermal LD_{50} in rabits is about 9

grams/kg). The extremely poor solubility also indicates poor absorption. Of greater concern is the respiratory irritation resulting from aspiration of the dust of inert carrier material prior to suspension in the carrier, although information from manufacturer suggests this has not been a problem. Dust protection is advisable. The absence of data on true dosage from dermal absorption of atrazine necessitates use of data obtained from studies of 2,4-D. The very low dermal toxicity of atrazine suggests that those figures are very conservative, but an absorption of 0.1 mg/kg will be assumed.

Because of the insolubility and solid form of atrazine after deposition, skin contact with foliage will result in no or negligible absorption. Similarly, the potential for absorption following drift is very limited, if it exists at all.

Atrazine movement into water is very low, because in forestry it is usually used on untilled uplands, from which migration has been shown to be slight, and which are considerably removed from stream beds. If a hypothetical water contamination were set up, for example a transient concentration of 10 ppb, the dose to a 50 kg person drinking 2 liters would be 0.4 micrograms (0.0004 mg)/kg. This would be a one-time event because of the poor overland transit of atrazine. Even in agricultural practice (where irrigation runoff is collected in pits and held) the concentration remains well below 1 ppm.

In fish, atrazine does not accumulate more than 3-6 fold and is lost very quickly. One-half kg of fish taken from water containing 10 ppb, assuming the concentration remained at that level long enough for uptake to occur, would contain at maximum 30 micrograms of atrazine. The dose per kg to a 50 kg person would be 0.6 micrograms (0.0006 mg/kg).

Because atrazine is used in the spring, consumption by deer does not represent a problem. The hunting season is several months later, and the rapid clearance of atrazine assures that no residues will remain in tissues of legally killed deer. Exposure of cattle should not take place, because atrazine destroys forage.

The residue concentration following atrazine application would be less than that for foliar herbicides because it is soil active, and relatively little moves across the cuticle of the leaf. Dried residues on leaves can be dislodged to the soil, especially by rain. A fair assumption of concentration would be 50 ppm/lb/acre, and at the maximum rate of 4 lb/acre, the foliage burden would be 200 ppm. Chemicals that are not highly fat soluble tend to achieve concentrations in muscle tissue of about 1-2 percent of dietary concentration or less. Bakke et al. (1972) found that rats given a single dose of about 1.8 mg/kg, which is equivalent to a day of intake at 25-30 ppm, produced a concentration in muscle of 0.6 ppm, which remained several days, and 3.5 ppm in liver, which decreased quickly. Newton and Norris (1968) found that deer taken between 10 and 40 days after application of atrazine on their range contained a maximum of 0.08 ppm in edible tissues.

The no-effect dose for reproduction is in excess of 200 mg/kg/day, but other effects indicate a no-effect dose for these calculations of 50 mg/kg. The maximal projected occupational dose of 0.1 mg/kg is 500 fold less than that figure. The maximum environmental dose from consumption of water or fish would not exceed 0.0006 mg/kg, which is 300 thousand fold less than the no-observable-effect level.

The absence of mutagenic or carginogenic ativity indicates no risk of such effects due to atrazine exposure.

Common Name: Dalapon

Chemical Name: 2,2-dichloropropionic acid

Major Trade Names: DOWPON, DOWPON M, DOWPON C, Radapon

Major Applications in Forestry: Site preparation, grass and vegetation control for maintenance and release of established plantations.

Summary

The fate of dalapon in the environment and its potential effect on nontarget plants and animals have been the subject of extensive studies. These studies indicate a relatively short environmental persistence and very low-order toxicity to aquatic and terrestrial organisms for dalapon.

Dalapon is absorbed via plant foliage and roots and is apparently not metabolized by plants to any appreciable extent. Residues on plant surfaces decrease very rapidly following application. Microbial degradation is the major contributing factor to the dissipation of dalapon from soil. Degradation rate has been highly variable among the soils studied and has ranged from complete disappearance in less than 2 weeks to two-thirds retention after 8 weeks. The decomposition is more rapid at warm temperatures, in the presence of adequate moisture and at a slightly less than neutral pH. Because of its high water solubility, dalapon is not adsorbed to soil particles to any appreciable degree and is subject to leaching. Field data, however, indicate that under many practical conditions dalapon does not move beyond the first 6-inch depth of soil, probably because microbial degradation proceeds at a faster rate than leaching under field conditions. Chemical degradation, volatilization and photodegradation are not important factors in dissipation of dalapon from soil under field conditions. Although actual data on persistence of dalapon in water are not available, based on laboratory BOD tests and the rapid biodegradation of dalapon in soil, dalapon is expected to undergo rapid biodegradation in the aquatic environment.

Dalapon is fairly selective against annual and perennial grasses, and little impact to nontarget conifers is expected in forestry applications. Crops susceptible to dalapon damage are also few, and no crop damage would be expected from possible drift due to applications in forest areas. At application rates of 5 to 15 lb/acre used in forestry, birds, fish, other aquatic organisms, honey bees and soil invertebrates in the spray area should not experience irreversible toxic effects. Based on tests with laboratory animals, dalapon has very low acute mammalian toxicity. Subacute feeding experiments with cattle, sheep, rats and hogs have indicated no mortality and in some cases only minor temporary symptoms. Chronic toxicity tests with dogs and rats have also indicated no effects under conditions tested. Based on results from experiments with rats and birds, normal uses of dalapon are not expected to have adverse impacts on mammalian or avian reporduction. The LC_{50} (see Glossary) for dalapon for 12 species of fresh water fish tested is greater than 100 ppm, thus indicating low order toxicity to fish. Dalapon at 50 ppm level has been shown to cause no mortality to fish eggs and fry for several fish species tested. Consistent with its high water solubility, dalapon does not present potential for bioaccumulation in animals. In laboratory tests, residues in the tissues of mammals and birds fed 10 to 1,000 ppm dalapon in their diet over periods of weeks, months or years remained below 100 ppm during treatment and soon fell to below one ppm when removed from exposure to dalapon.

Dalapon has essentially no effect on aerobic or anaerobic organisms in soil at dosages approximating commercial usage recommendations. A number of genera and species of algae, fungi and bacteria tolerate high dosages of dalapon and are capable of decomposing it.

Detailed information, summarized above, concerning the fate and behavior of dalapon in the environment and potential impacts may be found in the source documents USDA, FS (1981) and USDE, BPA (1982). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 25-26 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

Dalapon toxicity is limited. Much of the data discussing the toxicity of dalapon is proprietary but has been reviewed by Kenaga (1974). In a three generation reproduction study, no effects were found in rats on a daily intake of 150 mg/kg. A 2-year study in rats given 15 mg/kg/day also produced no effects, and a 1-year regime of 50 mg/kg/day to dogs also was without effect.

A study of teratogenic effects at doses up to 1,500 mg/kg/day showed a no-effect dose of 500 mg/kg/day, and higher doses caused only slight effects in the category of fetal toxicity.

Carcinogenicity studies of dalapon were not required at the time of registration because no food tolerances were requested. Lifetime studies designed to detect general toxicity showed no increase in tumor incidence. However, a mouse carcinogenesis assay is presently in progress and is expected to be reported shortly.

Mutagenicity tests of dalapon have been negative. While these have not been as extensive as the studies directed toward some other chemicals, the distribution, metabolism and excretion patterns of dalapon do not suggest that it should have genetic activity.

The maximum expected environmental dose of 0.11 mg/kg and a similar intake by applicators may be expected.

Teratogenic effects were absent at doses below 500 mg/kg, and genetic effects have not been detected. Teratogenic effects caused by chemicals during gestation are characterized by a threshold; doses lower than the threshold will have no effect.

The difference between the maximum expected exposure and the no-observed-effect dose for reproduction of 150 mg/kg is about 1,400, and for teratogenesis is about 4,500 fold.

Hazard Assessment

Dalapon is a water soluble herbicide used for grass control on uplands. The potential for direct movement to streams is almost zero because of distance and the demonstrated limitation of leaching (Kenaga 1974).

The extent of absorption of dalapon through skin is not known, although its high water solubility may facilitate absorption. Dermal toxicity tests have shown that prolonged contact at levels that cause local skin injury have no observable systemic effect.

The potential for absorption of dalapon may be assumed similar to that for 2,4-D and occupational exposure would probably be about the same. Backpack application should result in a maximum of 0.02-0.1 mg/kg/day, and exposure of a mixer-loader for aircraft application should be in that range as well.

Environmental exposure should be very limited, but several assumed exposures may be calculated.

Residues on grass will reach about 200 ppm/lb/acre immediately after application, decreasing to about 30 ppm/lb/acre in a week. The maximum use rate is 5 lb/acre, so it is possible to have a momentary residue in foliage of about 1,000 ppm. The significance of such an intake lies in ingestion of tissues of grazing animals.

Steers fed 100 ppm for 4 weeks accumulated residues of 1.1 ppm in tissues by the end of the period, and those levels decreased to 0.2 ppm in 4 days. Buildup to the maximum should not occur in 4 days, and it may not be linear, but an assumption of proportional tissue deposition may be made, so that a 1,000 ppm content in diet can be said to leave a residue of 11 ppm. Consumption of a half kg of such meat would deliver a total of 5.5 mg dalapon, which for a 50 kg person would be a dose of 0.11 mg/kg. Consumption of that amount for an extended period would result in such a dose daily.

Such exposure will not occur to humans because the material will disappear from browse completely before the hunting season several months hence, and all intake by game animals will likewise disappear.

Common Name: Dicamba

Chemical Name: 3,6-dichloro-o-anisic acid

Major Trade Names: Banvel

Major Applications in Forestry: Dicamba is used primarily for plantation maintenance and release, roadside spray and weed control in the Pacific Northwest.

Summary

Most of the studies on the fate of dicamba in the environment have been on non-forest systems. There is a limited amount of data available in connection with application to forests.

The degradation of dicamba is favored in soils with a high organic matter and moisture content and at higher temperatures. Degradation is primarily due to microbial action. Under field conditions, dicamba will probably not persist more than several months in most soils. The products of dicamba degradation in soil are 3,6-dichlorosalicyclic acid and CO2.

Dicamba has been shown to volatilize from soil and leaf surfaces, but the extent and significance of losses due to volatilization have not been determined. Dicamba is considered to be a very mobile herbicide. The dimethylamine salt is extremely water soluble. Studies have shown that salts of dicamba readily leach in soil and that there is very little adsorption of dicamba onto most soil types. Photodecomposition is probably not a major route of degradation.

There are few studies available on the fate and persistence of dicamba in water. Model ecosystem studies indicate that dicamba and its metabolites persist in conjugated or anionic forms in water. It slowly transforms to 5-OH dicamba in water (about 10 percent after 32 days) and is very slowly decarboxylated.

Dicamba is phytotoxic to a variety of plant species, including conifers. Plant susceptibility depends on differences in the distribution of dicamba within a plant and differences in the rate of absorption, translocation and metabolism. Dicamba has a low level of acute toxicity to mammals and birds. The oral LD_{50} of technical Banvel to rats and mallard ducks is 1,707-2,900 mg/kg and 2,009 mg/kg, respectively. It is more toxic to fish. The 96-hour LD_{50} is 135 mg/1 for bluegills and rainbow trout. Dicamba has been shown to be relatively non-toxic to bees. It does not bioaccumulate.

Carcinogenicity and mutagenicity were not detected at test dosages. Limited teratogenic properties have been found in rabbits at dosages over 10 mg/kg/day.

Detailed information, summarized above, concerning the fate and behavior of dicamba in the environment and potential impacts may be found in the source documents, Ghassemi et al. (1981); USDA, FS (1981); and USDE, BPA (1982). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 29-31 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

The bulk of data on the toxicology of dicamba has been generated by the manufacturer or its contractors as requirements for registration of the herbicide. Summaries of the data are available, but details are proprietary and not available for public use.

As a general case, dicamba seems to be among the least toxic of the herbicides. However, there appears to be some reproductive sensitivity, because in rabbits there was some early gestational loss at a dose rate of 10 mg/kg/day. At 3 mg/kg/day no such changes appeared. The no-effect dose for teratologic change was 10 mg/kg/day.

Dicamba has no apparent genetic activity in a dominant lethal assay in animals given 1,000 mg/kg orally. Microbial assays, including host mediated tests, were also negative.

Carcinogenicity has been evaluated in mice at 100 and 1,000 ppm in the diet, in rats at 500 ppm, and dogs at 50 ppm. No evidence of tumor induction was found. The mouse study was shortened from 24 months to 19.5 months for unspecified reasons.

If a no-effect level of 3 mg/kg for reproductive deficits is accepted, it would seem advisable to restrict female applicators from working with this chemical. Other general effects occurred only at very high doses and represent no hazard to applicators.

The use of ground application obviates spray drift as an environmental hazard. If water were consumed from an immediately adjacent stream containing 10 ppb dicamba, the 2-liter dose to a 50 kg person would be 0.0004 mg/kg. This is not a repeatable dose and is excreted within 6-10 hours.

There is a difference of 7,500 fold between the reproductive no-effect level and that intake, which represents no hazard.

Hazard Assessment

Dicamba (Banvel) has rather limited use in forestry. Typical use rate is about 1 lb/acre. Occupational exposure may occur in handling of the concentrated material, which is provided as about 4 lb of the dimethylamine salt per gallon of water.

Because dicamba will be applied on the ground by backpack sprayer, the applicators also have considerable expectation of exposure. The extensive data obtained from studies of 2,4-D exposure is directly applicable to dicamba, and the maximum daily intake by applicators will be no more than 0.1 mg/kg. No direct data on absorption through skin is available, but dermal toxicity data suggest that transport across skin is less than that for 2,4-D. As a conservative estimate, however, the data applicable to 2,4-D will be used as a guide.

There may be a somewhat higher probability of environmental contact with dicamba than with some other herbicides because it does not bind as tenaciously to organic and inorganic matter as do most other agents. It has a greater mobility in soil than most other herbicides, but not to the extent that it has a significant tendency to migrate from use sites.

There is somewhat greater tendency for any dicamba deposited adjacent to a stream to wash in with the first rain after an application because of the limited binding. Norris and Montgomery (1975) studied a watershed in western Oregon within which a dicamba-2,4-D treatment was adjacent to, and at some points crossed, small tributaries of a creek that discharged from the area at 57 liters/sec. A 1 lb/acre treatment resulted in a peak concentration at outlet of under 40 ppb, about 5 hours after application, without buffering the small tributaries. The stream into which the feeder discharged peaked at 10 ppb shortly thereafter, and at the end of 1 day the herbicide could no longer be detected. Under present day practices, it is unlikely that even that level would be reached at any point in the system, but an assumption of a single day peak of 10 ppb may be accepted for hazard assessment purposes. A 2-liter water consumption by a 50 kg person would result in a dose of 0.0012 mg/kg. Dicamba concentrates in fish to a level less by a factor of 8-10 than that of the surrounding water (Yu et al. 1975). (Spray drift is not a major concern in the proposed use of dicamba because it will be applied from the ground, and it is likely that no residues will reach streams by direct application or drift.)

Common Name: Diquat

Chemical Name: 1, 1'-ethylene-2,2' dipyridylium ion

Major Trade Names: Diquat, Reglone

Major Applications in Forestry: Used to control aquatic weeds at BLM recreation sites.

Summary

Diquat is effective against a broad spectrum of aquatic weeds. It has a high margin of safety as long as the recommended rates and precautions are strictly followed.

Toxicity

Diquat is of intermediate toxicity. Concentrated doses could cause problems in mammals' lungs and gastrointestinal tracts. Results of long-term feeding experiments at low dosages indicate no observable ill effects or detectable residues in tissues or milk. When used in aquatic environments, dilution reduces hazards to negligible levels, and persistence is 8 to 11 days.

Hazard Assessment

In plants not directly treated with diquat, no residues were found. Rapid and strong adsorption of the herbicide by soil limits its spread and uptake by roots. Animals could absorb diquat residues through ingestion of treated water. Although diquat residues have been detected in fish, accumulation in tissues and organs is negligible except in the digestive tract. Evidence indicates that the ingested chemical is excreted readily as demonstrated by its disappearance when residue-containing fish were transferred to nontreated water.

The mechanisms mainly responsible for the fate of diquat in soils are absorption, microbial degradation and photodegradation. Loss via volatilization is nonexistent due to the negligible vapor pressure of the compound. Due to its cationic nature, diquat is absorbed strongly by clay minerals through cation-exchange reactions. Adsorption is independent of pH and temperature and, after an equilibration time of 1 hour, the absorption was complete and independent of time.

Detailed information, summarized above, concerning the fate and behavior of diquat in the environment and potential impacts may be found in the source document USDA, FS (1981). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference.

Common Name: Diuron

Chemical Name: 3-(3,4-dichloro-phenyl)-1-dimethylurea

Major Trade Names: Karmex, Aceto Diuron

Major Applications in Forestry: Used by BLM for roadside spray and weed control.

Summary

Diuron is a persistent chemical, sometimes lasting 24 months. Decomposition by microorganisms may reduce persistence under moderate environmental conditions. Persistence is also affected by adsorption, which varies by soil types. Under most climatic and soil conditions, the rate of diuron disappearance will equal or exceed 80 percent per year, depending on soil type.

Diuron has a low order of acute toxicity. Teratogenic properties exist at very high dosage levels but not at moderate or low dosages. Mutagenicity studies are not available, and carcinogenic studies are inconclusive.

Detailed information, summarized above, concerning the fate and behavior of diuron in the environment and potential impacts may be found in the source documents Ghassemi et al. (1981) and USDA, FS (1981). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 31-33 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

Diuron is of limited toxicity. Hodge et al. (1967) examined a number of indices in rats and dogs while studying reproductive and carcinogenic effects. Pathological changes in animals maintained for 2 years on a diet containing 2,500 ppm diuron were substantial, but at 125 and 250 ppm and below there was no effect other than an abnormal blood pigment in a few animals.

Reproduction was evaluated in a three generation, two litter study, conducted twice. There was no apparent effect at any point. In one group post-weaning, growth was depressed slightly, but the effect proved to be due to factors other than treatment. Two teratogenicity studies have been done. Bionetics Research Laboratories examined diuron in two strains of mice given 215 mg/kg/day

and was reported by the MRAK Commission to have found no effects.

Khera et al. (1979) reported treatment of rats at 125, 250 and 500 mg/kg daily. Some decline of maternal weight occurred at the highest dose. A significant increase in wavy ribs occurred at all doses and a questionably significant increase of delayed ossification of the calvarium. There is argument whether these effects are in fact teratogenic, or simply fetal toxicity resulting in delayed development. The latter interpretation is probably correct, but the effect is apparently present and must be evaluated for potential human health impact. It is likely that such effects would not be considerable in humans because of the much longer period of gestational development. In any case, it is not feasible to assign a no-effect level, although the character of the data would suggest that it would be found at about 50-75 mg/kg.

Diuron is apparently not carcinogenic. Hodge et al. (1975) did a rather comprehensive study at low doses, with 35 males and 35 females at each dose, plus supplemental studies with almost as many additional animals. No carcinogenic effect was found, although at 2,500 ppm, the highest dietary level, much non-neoplastic pathology appeared. Innes et al. (1969) reported the carcinogenesis studes done at Bionetics Research Laboratories. Diuron fed at 1,400 ppm for 78 weeks produced no effects; however, only 18 mice per sex, in two strains were used.

A Russian study by Rubenchik et al. (1973) found a carcinogenic effect, but the work is seriously compromised. The single dose rate of 450 mg/day is higher than the amounts found to cause serious non-carcinogenic pathology. There is no information on the purity of the chemical. The diet was rice, which is low in protein, and otherwise inadequate. The paper gives no information on mortality rates, causes of death, or sex of experimental subjects, all of which are essential. The absence of graded doses is also a serious detriment to the usefulness of the work. Overall, the work cannot be used as an index of carcinogenic activity of diuron.

Hazard Assessment

Diuron is used as a road and right-of-way maintenance herbicide, but is not used in reforestation. It is active after reaching the ground and interacting with water. Because of this use pattern, there is minimal deposition on foliage, little drift, little or no opportunity for movement to streams or for intake by game.

Occupational exposure to the powder formulation may occur during mixing, and the principal concern is protection against inhalation of the dust, which is somewhat irritating. As a dry powder, absorption across the skin is negligible. Exposure to the mixed slurry as it is applied by machinery is unlikely with proper procedure and garments, but a backpack applicator may have some contact. A maximum dose of 0.05 mg/kg will be assumed. The nature of the chemical and the mix is such that absorption will be much less than the maximum of 0.1 mg/kg assumed to result from contact with phenoxy herbicides.

Potential for environmental exposure is markedly different than that expected to result from use of reforestation herbicides. Diuron is used only on roadsides and similar areas. The application area is very long and narrow, within rights-of-way. The chemical is applied almost entirely to areas that have been built up with fill or scarified. Because it is deposited from ground level, drift is minimal. Droplet shattering and some movement of small particles is to be expected, however, for perhaps 10 feet from the spray zone.

Diuron is quite persistent in soil (Majka and Lavy 1977; Miller et al. 1978), and in gravel and subsoil around roads should remain intact longer than on agricultural land. It has little tendency to migrate in soil, however (Willis et al. 1975). Because of the lack of mobility and the virtual absence of exposure of water courses that would supply potable water, exposure of drinking supplies is not a factor in hazard assessment.

The only route of admission to streams would be by improper application at a point where a road crosses a flowing stream. The area drained will be very small, with no potential for application along a significant length of stream bank. The resultant intake by fish would be negligible. Accumulation, if taken in by fish, should be limited judging from the character of the chemical, but specific data on tissue binding is not available.

Game animals have little contact with diuron as used in road maintenance. The areas treated have very poor vegetation, and the existence of the right-of-way tends to inhibit most animals, even well socialized deer. The long, narrow areas treated mean that for any given animal, the ratio of area treated to total range of the animal is exceedingly small. Consumption of significant amounts of diuron in game is probably not possible. Diuron is intended to act through the roots and is applied to the ground rather than on foliage, which further diminishes potential intake by game.

Consumption of berries and mushrooms is not a factor in the risk pattern for the use of diuron. Some berries are near rights-of-way, but no one should be able to reach them without encountering warning notices. Mushrooms worth picking are not likely to grow in the areas to be affected. Unlike application along general county and state roads, treatment adjacent to house yards and gardens will not occur.

If the reproductive no-effect level is assumed to be 50 mg/kg, the maximum occupational exposure should be on the order of 1,000 fold lower. None of the modes of environmental exposure are seen as significant. A carcinogenic effect has not been demonstrated, although a Russian study with diuron of unspecified purity, at doses that cause significant toxicity, and with much essential information left out, reported increased tumor incidence at a dose rate of 450 mg/kg.

Common Name: Fosamine ammonium

Chemical Name: Ammonium ethyl carbamoylphosphonate

Major Trade Names: Krenite

Major Applications in Forestry: Used primarily for woody brush and weed control in site preparation and conifer release.

Summary

Fosamine ammonium is a relatively new herbicide which has been commercially available only in the past few years. The available data on efficacy and environmental fate and impacts are largely from laboratory and field tests with non-forest systems conducted mainly by the manufacturer.

The principal mechanism of fosamine ammonium uptake by plants is through foliage, stems and buds. In the spring following treatment, bud development is suppressed. Susceptible species fail to refoliate or they produce miniature, spindly leaves and die. In soil, fosamine ammonium degrades rapidly via microbial and (to a lesser extent) chemical routes. The major chemical degradation route is hydrolysis to give carbamoylphosphonic acid (CPA), which also degrades rapidly in soil. Fosamine ammonium losses from soil due to volatilization and photodecomposition are not expected to be appreciable. In pasture flora, fosamine ammonium is metabolized to CPA and carboxyphosphonic acid.

Despite its water solubility, fosamine ammonium is a low mobility herbicide. Leaching and desorption from soil are lowest in soils with high clay and heavy metals content. Some fosamine ammonium hydrolysis occurs in water.

Fosamine ammonium is phytotoxic to many non-target woody forest and non-forest species. Pines are the most susceptible conifers, particularly in spring and summer. Krenite has low toxicity to fish and mammals. It is excreted and/or metabolized rapidly by animals and is considered non-bioaccumulable. It is considered non-toxic to soil microorganisms but has been shown to decrease the rate of nitrification of certain algae.

Detailed information, summarized above, concerning the fate and behavior of fosamine ammonium in the environment and potential impacts may be found in the source documents, Ghassemi et al. (1981) and USDA, FS (1981). In

accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 28-29 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

Fosamine is a relatively new herbicide, for which almost no toxicological data has been published in the open literature. The manufacturer has prepared a summary of findings for public use, but the data are held as proprietary by the manufacturer and EPA . . .
It may be assumed for purposes of appraisal that that exposure will result in a dose of 0.1 mg/kg to the most highly exposed crew member.

Fosamine is among the least toxic of common chemicals. The lethal dose is about 2.5 percent of body weight. When fed as 1 percent of the total diet (10,000 ppm), fosamine had no effect in a one generation reproduction study, and this dose (about 600 mg/kg/day in the rat) was not teratogenic. A summary of results is available (Haskell Lab. 1979b), however, but data details are proprietary.

Accumulation in fish does not occur; exposure by ingestion of fish will deliver less fosamine than consumption of water after treatment. Rapid excretion results in limited residues in animal tissues.

Because 10,000 ppm fosamine over a 6-month period caused increased heart and stomach weight in dogs and slight kidney changes in rats, the chronic no-effect level is considered as 1,000 ppm or about 60 mg/kg/day.

Ames type mutagenicity tests have shown no effect. Carcinogencity tests are now being completed for fosamine; they were not done earlier because as a chemical for which no food tolerances were requested, with no mutagenic activity, no cancer studies were indicated.

Hazard Assessment

Because fosamine can be used near water, the potential harm from consumption of directly treated water adjacent to stream banks must be evaluated. A maximum rate of 5 lb/acre on water 10 cm deep would leave an immediate hypothetical concentration of about 5 mg/L or 5 ppm. Two liters of water directly treated would deliver a dose of 0.2 mg/kg to a 50 kg person.

Applicator exposure may reach 0.1 mg/kg for mixer-loaders, and an exposure of 0.2 mg/kg from directly treated water can be imagined, however unlikely. These exposures can only be very short lived. When compared to the chronic no-effect level of about 600 mg/kg, these expected doses are about 6,000 and 3,000 fold less.

Common Name: Glyphosate

Chemical Name: N-(phosphonomethyl) glycine

Major Trade Names: Roundup, Kleenup

Major Applications in Forestry: Glyphosate is used for site preparation, conifer release, post directed sprays and tree injection.

Summary

Being a relatively new pesticide, the environmental fate and potential ecological effects of the use of glyphosate in forests have not yet been extensively studied. The limited data which are currently available are almost entirely from greenhouse and laboratory studies with agricultural systems and laboratory animals and have been largely generated by the manufacturer. These data indicate high effectiveness, short persistence in soil and water environments and very low toxicity to animals for glyphosate.

Glyphosate is absorbed almost exclusively via plant foliage and is translocated throughout the plant. Less than one percent of the glyphosate in the soil is absorbed via the roots. Glyphosate is apparently not metabolized to a significant degree in plants, and its mode of action is believed to involve inhibition of aromatic amino acid synthesis. It is rapidly and strongly adsorbed to soil particles. This strong adsorption by soil accounts for the observed lack of mobility and leaching tendency of glyphosate in soil and its "unavailability" for root uptake. Adsorption to soil is believed to be through the phosphonic acid component, since phosphate level in the soil influences the quantity of glyphosate adsorbed, and glyphosate adsorption is greater in soils saturated with Al^{+++} and Fe^{+++} than with Na^{+} and Ca^{++}.

Dissipation of glyphosate in soil is fairly rapid (half-life about 2 months) and is primarily due to microbial degradation. The principal soil metabolite of glyphosate is aminomethylphosphonic acid (AMPA), which itself is also highly biodegradable. Glyphosate is subject to biodegradation in natural waters and has an estimated half-life of 7 to 10 weeks.

Under normal application rates, glyphosate should not be toxic to forest fauna at recommended application rates. Bioassay tests on several aquatic invertebrates and fishes have indicated 96-hr LC50 values ranging from 2.3 mg/l for fathead minnows to 43 mg/l for mature scuds. Animal feeding studies with glyphosate have indicated low toxicity to rat, mallard duck and quail and little or no potential for bioaccumulation. Teratogenicity was not detected at test dosages. Carcinogenicity and mutagenicity studies are not available. Glyphosate can cause skin and eye irritation to applicators.

Detailed information, summarized above, concerning the fate and behavior of glyphosate in the environment and potential impacts may be found in the source documents, Ghassemi et al. (1981); USDA, FS (1981); and USDE, BPA (1982). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 19-21 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

The toxicity of glyphosate is very limited. However, this chemical is among those for which most data is proprietary and only summary information is available. The experimental data submitted for registration has been examined by F. N. Dost, however, and it is reflected accurately in the available summaries.

Teratology studies were negative at 30 mg/kg/day, which was the highest dose studied. A three generation reproduction study at 300 ppm (about 18 mg/kg) was negative.

Glyphosate was tested in the microbial mutagenicity tests necessary to registration and a mouse dominant lethal assay and found negative.

A mouse carcinogenesis study, and 2-year studies in rats and dogs showed no evidence of carcinogenic potential. The latter two tests were not designated specifically to detect carcinogenic activity, however, and a second carcinogenesis test is nearly complete. Existing tests and the behavior of the chemical indicate that carcinogenic potential is very low or nonexistent.

Hazard Assessment

Exposure to glyphosate must be considered in the same terms that describe exposure to the phenoxy herbicides. Because of lower application rates, it should be expected that aerial application crews and backpack sprayers may experience a maximum intake of 0.05 mg/kg, assuming rates of absorption similar to those of 2,4-D. Because of the tenacious binding of glyphosate to foreign material, it is questionable whether the absorption rate is as high as that of 2,4-D.

Contamination of water will dissipate quickly because of the binding of glyphosate to sediment and exclusion thereby of the chemical from routes leading to human consumption. Nonetheless, a transitory concentration of 7-10 ppb may occasionally occur and can be used in this assessment.

Drift of glyphosate will behave as any other herbicide, with deposition at 100, 500 and 1,000 feet of about 0.1, 0.005, and 0.001 mg/ft^2 per pound applied/acre. At 100 feet, skin absorption following contact with 0.2 mg/ft will be about 0.04 mg at maximum of 0.0008 mg/kg.

Consumption of glyphosate by game animals will be followed by very quick elimination, and it is not reasonable to expect significant exposure through consumption of game.

Glyphosate is applied in spring and summer into September. Concentration at the levels of vegetation used as browse may range from 20-200 ppm at application, depending on the density of the canopy. Degradation halftime is about 10 days in vegetation, and concentrations from late application will decrease prior to hunting season to from 12-25 percent of the original levels. Earlier applications will have disappeared. If the extreme of 200 ppm is accepted, a deer consuming 3 percent of body weight daily will take in 6 mg/kg/day. Studies with triclopyr discussed later show tissue burden in liver to be about 2 percent of dietary intake in mg/kg and muscle concentration to be 1.5 percent or less. The very rapid excretion of glyphosate means that that relationship can be used here, although that at any given time body burden should be even less. The expected maximum tissue concentration should be about 0.12 ppm.

Consumption of a half kilogram of such meat by a 50 kg person would bring in 0.05 mg glyphosate or 0.0012 mg/kg for a 50 kg person.

An occupational intake of 0.05 mg/kg is less than the no-effect level of 30 mg/kg/day for teratogenesis by a factor of 600. The maximum environmental exposure would hypothetically result from consumption of deer meat, leading to a dose of 0.0012 mg/kg, which is less than the reproductive no-effect dose by a factor of 25,000.

Present evidence indicates no mutagenic or carcinogenic potential of glyphosate and an assessment of such risks is therefore not necessary.

Glyphosate potentially contains a genetically active contaminant, N-nitrosoglyphosate. EPA has determined that to the extent it occurs in glyphosate, it does not represent a mutagenic or carcinogenic hazard.

Common Name: Hexazinone

Chemical Name: 3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4 (1H,3H)-dione

Major Trade Names: Velpar

Major Applications In Forestry: Used primarily in the Southeast and Southwest for site preparation and pine release, and the Northeast to a lesser extent to control undesirable hardwoods in forest situations.

Summary

Hexazinone is a relatively new herbicide which is being evaluated as a possible substitute for 2,4,5-T for site preparation and conifer release. Because of its relative newness, field trials of Hexazinone to date have primarily emphasized evaluation of efficacy with environmental fate and impact studies in progress. The data which are available on soil residues, degradation and impacts on nontarget organisms are primarily those generated in laboratory, greenhouse, field and forest studies by the manufacturer or investigators in connection with the registration of various formulations.

Root uptake is the principal mechanism for the absorption of hexazinone by plants from soils treated with pellets. Hexazinone is translocated to the foliage where it blocks the photosynthesis process. In addition to plant uptake, hexazinone is dissipated in soil via photodegradation, biodegradation and leaching. Depending on field conditions, half-life of hexazinone in soil may be as short as 1 month or in excess of 6 months. The half-life appears to be independent of the application rate. Laboratory and field leaching tests have indicated that hexazinone and some of its degradation products would be washed into the soil with rainwater. Photodegradation and biological decomposition are the major factors in reducing hexazinone concentration in natural waters.

In applications of hexazinone for conifer release, 0-15 percent conifer mortality may occur, but this is dependent on species, rate, soil type and other factors. Aquatic toxicity data indicate that Hexazinone is only slightly toxic to *Daphnia* and fish. The product also does not bioaccumulate in fish. Toxicity tests have indicated that hexazinone has low toxicity to birds, wildlife, fish and mammals. From 2 years of extensive toxicological studies, no evidence of carcinogenicity, teratogenicity or mutagenicity has been found.

Detailed information, summarized above, concerning the fate and behavior of hexazinone in the environment and potential impacts may be found in the source document, Ghassemi et al. (1981). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 26-28 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

As with atrazine, the toxicity of hexazinone is apparently very limited. Because the chemical is relatively new, almost all existing information is proprietary, held as trade secret by EPA and the manufacturer. A summary has been made available by Haskell Lab. (1979a). Rats have tolerated 300 mg/kg daily, 5 days a week for 2 weeks and 1,000 ppm (about 80 mg/kg) for 90 days, without effect. Dogs tolerate a similar dietary level without harm but suffer some liver damage at a dose five-fold greater. Mice at 5,000 ppm (almost 1,000 mg/kg) were not affected.

A diet containing 1,000 ppm (about 60 mg/kg) hexazinone caused no discernable change in a three generation, three litter rat reproduction study. At 5,000 ppm (about 300 mg/kg) on days 6-15 of gestation, no teratologic effect was found. The microbial mutagenicity screen indicated no genetic activity. There is apparently no carcinogenic activity by hexazinone. Some weight loss was observed at very high doses. At 2,500 ppm some hematological and urinary changes were detected but no tissue pathology. A second study in hamsters was stopped at 48 weeks because of an outbreak of infectious disease in the colony.

Hazard Assessment

Hexazinone is a triazine herbicide chemically similar to atrazine but with a broader spectrum of susceptible plant species. Its environmental chemistry is quite similar to that of atrazine, and exposures by all routes should be the same as those associated with a similar amount of atrazine. Unlike atrazine, hexazinone may sometimes be used in lowlands, and an assumption of proximity to streams on at least some occasions is necessary.

As with atrazine, however, migration overland in the untilled forest floor should be negligible. Hexazinone is more soluble than atrazine but not sufficiently so to dissolve the amount needed for treatment; a co-solvent, usually methanol, is used to maintain the solution.

Dermal exposure to applicators may be equated to that observed in studies with 2,4-D, in which the maximum dose to mixer-loaders was about 0.1 mg/kg. That actual dose would suggest a skin exposure perhaps 10 times greater, about 1 mg/kg/day. No data on skin absorption of hexazinone is available; it is assumed to be on the order of 10 percent, and it may be expected that the maximum dose to backpack applicators and mixer-loaders would be about 0.1 mg/kg, based on evidence with 2,4-D.

The methanol used as a solvent represents some occupational hazard; mixing must be done in ventilated or open areas and protective clothing is necessary.

Hexazinone is applied in spring, before the overstory leafs out, which allows the entire treatment to reach the herbaceous layer. When it reaches the soil, it remains essentially in place until it degrades.

Drift of small particles will behave as does 2,4-D, and the extent of skin contact and water contamination at 100 feet will be similar. Consequently, maximum deposition on skin should be on the order of 0.1 mg/ft^2/lb applied, or a maximum of 0.8 mg immediately adjacent to and downwind of the target area with buffer. Absorption of 10 percent would provide a dose of less than 0.002 mg/kg to a 50 kg person. Water 6 inches deep at the edge of the buffer could reach a concentration of 30 ppb, 2 liters of which would contain 60 mg or 1.2 mg (0.0012 mg)/kg.

As with other herbicides, residues of hexazinone in fish do not represent significant intake. Rhodes (1980) found that bluegill muscle contained a maximum of 0.02 ppm hexazinone in the presence of 0.01 ppm in water. In water containing 1.0 ppm, the maximum accumulation factor in edible tissue was also 2.

Because of spring treatment, consumption by deer represents no secondary toxicity problem.

Rhodes and Jewell (1980) administered 50 mg of labeled hexazinone/kg to a rat that had been preconditioned by a diet containing 2,500 ppm (about 130 mg/kg) hexazinone. Urinary and fecal excretion were so fast that at the 72-hour sampling time, no radioactivity could be found in any tissue except a trace in the digestive tract. It is likely, therefore, that tissue residues are very low, but it is not possible to discern how much lower than suggested for atrazine. Nonetheless, the projection for atrazine will be used here, which leads to an extremely unlikely maximum dose of 0.15 mg/kg.

The maximum applicator dose is smaller than the daily no-effect level for general toxicity by a factor of at least 3,000 and smaller than the reproductive no-effect level by at least 600 fold. (In those studies doses were not raised to the effective level; the true no-effect level is somewhere in excess of the stated doses).

The possibility of acquiring 0.15 mg/kg under a very special set of conditions would give a dose less than the reproductive no-effect level by about 400 fold. Water and fish as a medium are essentially inconsequential.

No genetic effects have been seen at the highest doses tolerated by experimental animals, and no safety factors are applicable.

Common Name: MSMA

Chemical Name: Monosodium methanearsonate

Major Trade Names: Ansar; Bueno; Daconate

Major Applications in Forestry: Used in precommercial thinning; applied by injection or cut surface.

Summary

MSMA is an organic arsenical herbicide that is used to thin conifers by injection or by application on cut tree surfaces, but the total amount used in forestry is a small fraction of the agricultural use. The primary environmental concern in the use of MSMA is arsenic toxicity. MSMA itself is less toxic to most animal species than is inorganic arsenate, the primary breakdown product. MSMA is converted to several other organic and inorganic arsenicals in the environment. However, MSMA and all of these products occur naturally in soils, in water and in the tissues of organisms. Furthermore, the amount of MSMA annually produced and used in the United States is a small fraction of the amount of arsenic that occurs naturally in the soil.

Toxicity

MSMA is moderately toxic to rabbits and to cattle. It has low toxicity to fish and birds, and it has moderate toxicity to honey bees when they are sprayed or when they ingest contaminated food. Proper use of MSMA in forestry is unlikely to harm wildlife or domestic animals.

Hazard Assessment

In most surveys, agricultural use of MSMA has not resulted in a significant increase above the background arsenic content of soil. The major breakdown product of MSMA in soil is inorganic arsenate which is relatively quickly and tightly bound in soil. Therefore, entry of MSMA into soil does not significantly increase the risk of contamination of drinking water by the leaching of arsenic from soil. In forestry, arsenic from MSMA in soil does not significantly increase the risk of contamination of drinking water by the leaching of arsenic from soil. In forestry, arsenic from MSMA use enters the soil when foliage of treated trees decomposes, and no contamination of streams by this arsenic has been detected. Arsenic does accumulate in the tissues of organisms. However, in animals, it tends to achieve the highest concentrations in species at the bottom of food chains, and it does not appear to biomagnify in food chains.

Potential impacts on nontarget organisms: Wildlife was sampled for tissue residues after forest application of arsenicals including MSMA. The reported results placed the animals in two groups: those in which there were generally no detectable residues and those in which low levels were found. Essentially no residues were detected in several species of birds, mountain beaver, porcupine, ruffed grouse and deer. The low level group consisted of voles, shrews, mice, chipmunks and ground squirrels. Animals collected more than 30 days after herbicide injection generally exhibited no detectable residues.

Detailed information, summarized above, concerning the fate and behavior of MSMA in the environment and potential impacts may be found in the source documents, Ghassemi et al. (1981) and USDA, FS (1981). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference.

Common Name: Picloram

Chemical Name: 4-amino 3,5,6-trichloropicolinic acid

Major Trade Names: Tordon, Amdon

Major Applications in Forestry: Used in virtually all geographic regions of the U.S. primarily in site preparation and occasionally in precommercial thinning and conifer release.

Summary

The fate of picloram in the forest environment has been the subject of limited studies. Most of the available information on the fate of picloram in soil and water is the result of laboratory and/or field studies with agricultural systems.

Picloram is rapidly absorbed by plant roots and less rapidly by foliage. Once absorbed, it is readily translocated throughout the plant with a tendency for accumulation in new growth. It is very stable and remains largely intact within the plant.

Picloram is considered moderately to highly persistent in soils under conditions of normal application and may exist at phytotoxic levels for over 1 year. Reported half-lives vary from 1 to over 13 months. Persistence is generally shorter in soils with high organic matter content and adequate moisture such as may be present in forest soils, and in warm temperatures. Picloram degradation in soil occurs via microbial rather than chemical routes, but amounts of picloram decomposed are small. Picloram photodecomposition on soil surfaces occurs to the greatest extent under intense sunlight, and hence is not expected to be great in forest systems.

Picloram is considered a mobile herbicide and is reversibly adsorbed on soil particles. Adsorption is greatest in soils high in organic matter and increases with decreasing pH, particularly in clay soils. Leaching occurs to the greatest extent in sandy, light-textured soils and soils poor in organic matter content. Because of the water solubility of picloram and its salts and its leaching tendencies, runoff from treated areas can contain relatively high concentrations of picloram.

Picloram is phytotoxic to numerous nontarget plant species. It is very toxic to young pine seedlings. Several incidents of damage to nontarget plants due to picloram spray drift have been reported. Certain species of plants have been injured as long as 5 years after application as a result of the persistence of picloram.

Picloram and its salts are low in toxicity to fish and other aquatic organisms. It has low toxicity to warm-blooded animals, soil microorganisms and bees. Picloram is rapidly excreted by and does not bioaccumulate in mammals. Picloram in water is not accumulated in invertebrates or in food chains.

Carcinogenicity studies are being conducted. Mutagenicity and teratogenicity has not been detected at test dosages.

Detailed information, summarized above, concerning the fate and behavior of picloram in the environment and potential impacts may be found in the source documents, Ghassemi et al. (1981); USDA, FS (1981); and USDE, BPA (1982). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 16-19 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

The toxicology of picloram has been described in part in the open literature and in part in data submitted for registration of the compound and still held proprietary. Nonetheless, an adequate description of the biological effects of picloram is accessible, and a satisfactory assessment of hazard can be made.

Acute toxicity in mammals is less than that of 2,4-D by a factor of 10-15 fold. If the dose is raised sufficiently, a variety of nonspecific pathological changes can occur in the liver and kidney, but the no-observed-effect doses are quite high at about 80 mg/kg/day in rats. Dogs fed 150 mg/kg/day for 2 years were not affected.

A three generation reproduction study of 4 males and 12 female rats given up to 150 mg picloram/kg beginning 28 days prior to the first mating did not disclose any impairment of reproductive capacity that could be associated with chemical treatment.

Teratogenic effect was absent in rats at doses up to 1,000 mg/kg/day given through the period of organ formation. The doses were high enough that a number of maternal deaths occurred at the upper levels. Even at such intake, there was no fetal wastage among survivors, and no post-natal effects. Skeletal development was slowed at the highest dose.

Picloram has produced no detectable mutations in in vitro tests.

The research that has been done does not indicate that picloram is carcinogenic. The early studies were not designed as carcinogenicity assays but rather were lifetime general toxicity evaluations in which tumor formation was an incidental. At 150 mg/kg/day, no tumors were observed in rats. More recently, the National Cancer Institute (1978) carried out a study in rats and mice in which the animal work was contracted to a reputable private laboratory, but design and assessment was done jointly. Rats were maintained at average dietary concentrations of about 0.75 percent and 1.5 percent (7,437 ppm and 14,875 ppm) picloram in the diet for 80 weeks, then observed 33 weeks and killed.

Mice were given a diet containing about 0.25 percent and 0.5 percent (2,531 ppm and 5,062 ppm) for 80 weeks and observed for 10 weeks. (These doses are approximately 500 and 1,000 mg/kg/day in the respective species). (Lifespan is somewhat over 2 years for both species. It is generally assumed that genetic toxicity such as cancer occurs in lifespan fractions for species rather than calendar time; events that require half a lifetime in humans probably require half a lifetime in rats).

The observations of these studies showed a nonsignificant increase in thyroid tumors in rats, but not mice, and a significant increase in benign liver tumors in female rats.

The conclusion of the pathologists and the review team was that picloram was not carcinogenic in mice or male rats, and that picloram at high sustained doses could induce benign tumors in female rats.

The understanding of the hazards or lack of hazard associated with picloram is complicated in the public mind by a recent burst of allegations about increased cancer incidence in a North Carolina community and an association with picloram use. Demonstration by both the State of North Carolina and EPA that there is neither an increased cancer incidence nor detectable picloram entering the diet of the community has not stopped dissemination of the story. EPA has seen fit to issue a bulletin to establish the facts of the issue.

The fact that picloram is a restricted use chemical is incorrectly interpreted by some people as an indication of dangers to humans resulting from its use. Picloram is exceedingly toxic to crop plants, and a restricted label limits its use to licensed applicators who presumably can protect nontarget crops.

The public understanding of the carcinogenic risk associated with picloram has also been complicated by allegations made by a pathologist, until recently associated with the National Cancer Institute, that the evaluations of tissue pathology in the NCI studies were incorrect and that the statistical treatment of the data was also faulty. A variety of circumstances have led the scientific community to be highly skeptical of these allegations.

The data do not support a contention of carcinogenicity. However, it must be understood that there is an open and valid scientific question about the meaning of the nodules or benign tumors of the liver. It is generally considered that these changes do not represent a malignant process, because they tend to diminish with time after treatment ceases. There is body of opinion, however, that considers them as a precancerous development that if sustained will become malignant.

Hazard Assessment

Picloram is a pyridine derivative herbicide used for roadside maintenance, site preparation and for injection into larger trees that must be removed. Its environmental behavior differs from most other herbicides in that it is highly mobile in plants and can move into plants through the root system, and as the plant metabolism becomes depressed by the action of the herbicide it may move back to the roots, into the soil and on to other plants. It is used at much lower concentrations than other herbicides; when used with 2,4-D the ratio 2,4-D/picloram will typically be 4 to 1.

Occupational exposures to picloram will take place during aerial and backpack application and during "hack and squirt" treatments. Environmental exposures due to spray drift, surface contact, and consumption of the biota will follow the same principles that apply to other herbicides. The potential for water contamination is at least theoretically greater because picloram has much greater mobility in soil, and in conditions where much water is moving through soil picloram can travel much farther than, say, phenoxies. Instances are known where traces of picloram of unknown origin have been found in water supplies over an extended period.

Because of the smaller amounts used, the exposures by direct contact may be considered at maximum to be about one-half of the amount expected in exposures to 2,4-D, and in many cases will be as low as one-tenth of that amount. Backpack applicators and aircraft mixer-loaders should therefore be exposed to no more than 0.05 mg/kg. "Hack and squirt" applicators have not

been as thoroughly studied, but the data obtained on personnel applying MSMA, an arsenical, by this method, as well as the data obtained on eight applicators by the Josephine County, Oregon Health Department . . . indicate a maximum exposure of less than 0.01 mg/kg. It should be noted that this use requires application of the concentrated material, and worker discipline and care are essential. In the referred studies workers wore standard working clothing, with gloves, and consequently exposures were potentially greater than well protected workers should expect.

A maximum application rate of 2 lb/acre would deposit a maximum of 0.2 mg/ft^2 at the downwind edge of the buffer zone. Two ft^2 of exposed body surface could result in a maximum exposure of 0.4 mg picloram. Assumption of 10 percent absorption would indicate a dose of 0.04 mg/50 kg body weight or less than 0.001 mg/kg.

The concentrations in water as a consequence of direct drift from 2 lbs/acre at 100 ft, 500 ft and a quarter mile would be at maximum 15 ppb, 0.75 ppb, and 0.15 ppb, assuming a water depth of 6 inches, using the drift data alluded to in the section on phenoxy herbicides, and using the theoretical concentration, not the data obtained in direct field measurements, which are much lower. Concentrations in water as a result of migration in soil will not approach the maximum already calculated as a function of drift. The dose to a 50 kg person consuming 2 liters of water containing 15 ppb picloram, daily, would not exceed 0.0006 mg/kg. The situations in which picloram of unknown source has been found in water supplies have uniformly involved very low levels. The concern has not been about health risks per se, but that some use practice has been improper.

Because of the very rapid urinary excretion of picloram, tissue levels remain low and drop quickly after exposure. Tissue residues in cattle fed picloram have been found to be a very small fraction of the dietary concentration, and that fraction is relatively constant across a wide range of doses. At a maximum residue level of 100 ppm per pound applied, the maximum expected forage concentration of picloram would be 200 ppm. At that concentration, maximum muscle concentration should be about 0.05 ppm (Kutchinski and Riley 1969), and the concentration in liver would be about twice this amount. A half-kilogram daily of liver would therefore carry 0.05 mg picloram, or 0.001 mg/kg for a 50 kg person.

Although use rates for picloram are lower than those for 2,4-D, the same assumed maximum concentrations of 10 ppm in berries and 5 ppm in mushrooms will be used. Picloram accumulates in fish to a concentration much lower than the concentration in ambient water, according to research by the manufacturer quoted by the Canadian National Research Council (1974) review of picloram. Any consumption of such fish represents less exposure than consumption of water.

A comparison of the maximum doses expected for applicators (0.05 mg/kg/day) or non-occupationally exposed people shows that the short duration of exposure and very low exposure in the field leads to a dose that is at least 1,500 fold lower than the no-effect doses for general toxicity and reproductive effects, which are characterized by a threshold. The absence of mutagenic activity, the very rapid disposition of the chemical and the very limited tendency toward tumor formation in experiments at lifetime doses some 10,000 fold higher than brief doses in the field indicate that picloram does not represent a calculable carcinogenic hazard.

Common Name: Triclopyr

Chemical Name: 3,5,6-trichloro-2-pyridinyloxyacetic acid

Major Trade Names: Garlon 3A; Garlon 4

Major Applications in Forestry: Used for site preparation and occasionally in conifer release for woody plants and broadleaf weed control.

Summary

Triclopyr is a relatively new herbicide which has been commercially available only in the past few years. Accordingly, very little data are available in connection with its efficacy and environmental fate and impacts. The limited available data are largely from laboratory and/or field studies conducted by the manufacturer on non-forest systems.

The mechanism of triclopyr uptake by plants is through both leaves and roots. It induces characteristic auxin-type responses in plants. Triclopyr is not considered a persistent compound in soils; it degrades rapidly, with an average half-life of 46 days. The major route of degradation in soil is via microbial decomposition. Degradation of triclopyr does not occur to any appreciable extent via chemical hydrolysis or other chemical routes in soil. Triclopyr losses due to volatilization are not appreciable.

Triclopyr is considered a mobile herbicide. Leaching and desorption are lowest in soils with high organic matter content. Because of its mobility and rapid desorption from soil particles, some loss of triclopyr due to solubilization and/or runoff may be expected following field application. Although it is stable to hydrolysis in aqueous solution, triclopyr photodegrades rapidly with a half-life of 10 hours at 25° C.

Triclopyr can cause injury to conifers at high rates of application and must be used carefully for conifer release. When applied directly, it exhibits phytotoxicity to agricultural crops. Triclopyr has low toxicity to fish and lower aquatic organisms and does not bioaccumulate in these species. It exhibits low toxicity to wildlife and is considered non-toxic to soil microorganisms.

Testing produced no carcinogenic or mutagenic effects. It is considered mildly fetotoxic.

Detailed information, summarized above, concerning the fate and behavior of triclopyr in the environment and potential impacts may be found in the source document, Ghassemi et al. (1981). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 21-23 of the report "Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

The only available toxicology data for triclopyr is summary information that has been made available by personal communications with Dow Chemical toxicologists and product specialists.

The toxicity of triclopyr is on the order of that of the phenoxy group. Subchronic intoxication studies showed modest general effects at 100 mg/kg/day but no detectable change at 30 mg/kg in rats and 20 mg/kg in mice. In dogs, doses of 5 mg/kg lowered weight gain and produced liver and kidney effects over a 228-day period. This increased sensitivity is directly due to the uniquely poor ability of the dog to excrete organic acids.

Primates, including humans, have a very high capacity for organic acid excretion.

Triclopyr is not teratogenic at doses as high as 200 mg/kg/day. No reproductive effects were found in a three generation feeding study at 30 mg/kg/day.

Genetic toxicity is limited. Bacterial assays, mouse dominant lethal and cytogenetic studies were negative. A rat dominant lethal study was very weakly positive.

At 30 mg triclopyr/kg daily over a 2-year period, neither rats or mice showed evidence of carcinogenic activity. There was no evidence of toxicity of any kind.

Hazard Assessment

Triclopyr is similar in structure to 2,4,5-T, with a nitrogen located in place of the sixth ring carbon. It has no dioxin contaminants. Its degradation rate in the soils and conditions of western Oregon should be expected to be about 2 weeks, similar to the phenoxy herbicides.

Triclopyr has some mobility in laboratory leaching studies but in the field has been found not to penetrate beyond 12 inches into soil. Field studies also show movement overland to streams does not occur.

Exposure of applicators should parallel the experience with 2,4-D and 2,4,5-T. Backpack applicators and aircraft mixer-loaders should have maximum dosages of about 0.1 mg/kg/day. Analysis of "hack and squirt" applicators using 2,4-D and picloram have not shown significant blood or urine concentrations. A study of operator absorption and excretion of MSMA, an arsenical, indicate absorption of a maximum of 1 mg per day, which indicates a dose of 0.02 mg/kg/day.

The potential for an environmental exposure should also be similar to that for 2,4-D. Spray drift at 100 feet, 500 feet and one-quarter mile should deposit about 0.1, 0.005, and 0.001 mg/ft^2 per pound applied per acre. Assuming 10 percent absorption, and 4 lb/acre, a 50 kg person with 2 ft^2 of skin surface exposed would absorb less than 0.002 mg triclopyr/kg at 100 feet from the spray zone.

Potential for contamination of drinking water is low. Unless a major error is made, concentrations in streams adjacent to treated areas should only rarely approach 10 ppb. The theoretical level for a 6-inch deep stream at 100 feet is 30 ppb, however, and that figure is used here. The dose to a 50 kg person consuming 2 liters of water at that concentration will be 0.0012 mg/kg.

Triclopyr does not concentrate in aquatic species. Its metabolites concentrate only slightly, and when water concentration decreases, clearance is rapid. Potential for exposure through consumption of fish is less than for drinking water.

The concentration of triclopyr on foliage could be as high as 100 ppm per pound per acre, which means that in some circumstances a concentration of 400 ppm could result from a 4 lb/acre treatment. The rate of excretion by all species is very rapid, and tissue deposition is very slight. In goats, a reasonable surrogate for deer, 0.2 mg/kg of 14C-labeled triclopyr daily left no detectable residues in any tissue (detection limit 0.003 ppm) except 0.004 ppm in liver and about 4 times the detection threshold in kidney, which is the organ of excretion. Studies in rats indicate that tissue residues are proportional to dose rate, which is expected.

A 400 ppm residue on browse would translate to a maximum intake at the time of application of 12 mg/kg assuming that feed consumption is 3 percent of body weight per day. Tissue residues, assuming that in the above experiment undetected tissue residues were as high as the detection limit of 0.003 ppm, would be proportional to the dose and are assumed to be 0.18 ppm in muscle and 0.24 ppm in liver. Consumption of 0.5 kg of such meat daily would provide a dose of 0.09 mg total or 0.0018 mg/kg to a 50 kg person. The same amount of liver would raise the dose to 0.0024 mg/kg.

The maximum dose to applicators of 0.1 mg/kg/day is 2,000 fold less than the teratogenic no-effect level and 300 fold less than all other no-effect levels. In the chronic studies, true-effect levels were not reached, and the no-effect dose must be taken as the highest dose used.

The maximum environmental dose of 0.002 mg/kg is 100,000 times less than the teratogenic no-effect dose and 15,000 times less than the no-effect dose observed in other tests.

The conclusion must be that even under the worst situations that may arise in proper application of triclopyr, no hazard to humans can be identified.

Common Name: 2,4-D

Chemical Name: 2,4-dichlorophenoxyacetic acid

Major Trade Names: Weedone LV-4; Esteron 99 Concentrate; Weedar 64; Verton 2-D

Major Applications in Forestry: Used as a selective broadleaf weedkiller in connection with site preparation and conifer release.

Summary

Plants readily absorb, translocate and metabolize 2,4-D. The formulation influences the degree of absorption. Once absorbed, 2,4-D may be chemically altered by a variety of mechanisms. It is believed that residues at phytotoxic levels do not persist in the vegetation.

2,4-D is considered to be a relatively nonpersistent herbicide. The most persistent form of 2,4-D in the environment is the acid. Esters and amines of 2,4-D hydrolyze to the acid within a few days in the soil. Degradation of the acid is primarily microbial. In warm, moist soils with a high organic content, 2,4-D can degrade within days, but 2,4-D can persist for many months in the absence of favorable soil conditions. Leaching of 2,4-D is more extensive in soils with lesser amounts of organic matter and with a lower pH. Leaching and adsorption are inversely related. In general, 2,4-D remains within the top foot of the soil surface.

In water, esters of 2,4-D are rapidly hydrolyzed to the acid form. The persistence of the acid depends on the presence of microorganisms adapted to 2,4-D degradation. In cool, nutrient poor, natural surface waters, 2,4-D may remain stable for many months. Photodecomposition has been demonstrated in the laboratory, although the degree of 2,4-D degradation in the field with natural sunlight is unknown. Volatilization is usually not a major mechanism for removal of 2,4-D from water.

2,4-D is phytotoxic to numerous nontarget plant species including some crops and ornamentals. Conifers are susceptible during periods of rapid growth. The toxicity of 2,4-D to fish is highly variable depending on the species, the water quality, and the 2,4-D formulation. The acute oral LD_{50} of 2,4-D for some birds ranges form 300 to 5,000 mg/kg. It is generally less toxic to birds than to mammals. The toxicity of 2,4-D to honey bees is low. 2,4-D does not tend to bioaccumulate in fish or in mammals. Carcinogenicity was not detected at test dosages. Teratogenic effects were detected at dosage levels ranging from 20 mg/kg/day up to near acute lethal dosages. Conflicting data have resulted from mutagenicity studies.

EPA recently reviewed all available research and concluded that 2,4-D does not pose an imminent hazard or unreasonable adverse effect when used according to label precautions (U.S. EPA 1980).

Detailed information, summarized above, concerning the fate and behavior of 2,4-D in the environment and potential impacts may be found in the source documents, Ghassemi et al. (1981); USDA, FS (1981); and USDE, BPA (1982). In accordance with 40 CFR 1502.21, the aforementioned material is hereby incorporated by reference. The following discussions on toxicity and hazard assessment were taken from pages 11-16 of the report "An Analysis of Human Health Hazards Associated with Some Herbicides Used in Forestry," prepared for BLM by Dr. Frank N. Dost (1983).

Toxicity

The toxicological behavior of 2,4-D raises concern in four general areas: the chemical has been given a reputation as a serious reproductive intoxicant; it is known to cause musculo-neural injury in humans and in experimental animals at high doses; it is a weak mutagen; and it has been alleged to be a carcinogen. The reproductive and myoneural effects can be dealt with on a dose-response basis because the dosages necessary to cause such effects, where they can be caused, are known at least qualitatively. There is no question that 2,4-D has weak mutagenic activity in some of the many assays to which it has been subjected. It is very difficult to make the meaning of such information understood by the public. The allegation of carcinogenicity is based not on the existence of data, but on the absence of data. The research on carcinogenicity of 2,4-D has been deficient in various ways, and while the data is negative, it is not absolutely reliable for a scientific conclusion. However, neither is it a proper basis for concluding that 2,4-D is carcinogenic.

2,4-D has been studied intensively as a potential reproductive intoxicant. Like virtually every chemical, it can cause fetal toxicity if the dose is raised high enough, just as it and every chemical can intoxicate an adult animal. 2,4-D is a teratogen in some species, not in others. A teratogen is a chemical that when given during the period of gestation when organs and limbs are beginning to form, can cause derangement and abnormal structural development or "birth defects." This kind of effect is generally recognized by teratologists as being subject to a threshold, a dose below which no effect will occur.

2,4-D also has the capacity, as do many chemicals, to cause more subtle reproductive effects as decreased birth weights, decreased litter size and fertility and so on. Most of these changes occur at doses in the range where the adult animal is visibly affected, but the dose at which no change occurs has been variously determined at 25-35 mg/kg/day. We use 20 mg/kg/day as a conservative figure.

A precise dosage for onset of myotonia, in experimental animals, or the corresponding peripheral neuropathy that has been observed in a few humans is not as well known. In animals dosages high enough to cause significant general toxicity are required, on the order of 150-300 mg/kg. In the human, the condition has apparently only occurred after heavy exposure to the concentrated herbicide, although there are two or three cases where sustained heavy exposure to diluted material may have occurred, and in which some neurological effect was seen. Some cases of exposure, including one almost successful suicide attempt have generated no such symptoms.

The meaning of a limited mutagenic activity has not been translated into any kind of regulatory procedure by responsible agencies. Scores of common chemicals have some kind of activity in short-term genetic toxicity screens. 2,4-D has been found to have activity in several tests of in vitro genetic activity, almost all at very high concentrations, and it has been found to have no activity in many more tests than have been positive. The consensus among regulatory and other toxicologists is that the limited mutagenic activity does not represent a mutational hazard at amounts encountered either in the work place or the general environment. It is not possible to draw a reasonable quantitative relationship between such tests and the environmental exposures we are discussing. It is worth mentioning in the context of both mutagenesis and carcinogenesis mentioned above, however, that a food tolerance of 100 ppb exists for 2,4-D, and the allowable water concentration is 50 ppb, for lifetime consumption.

The carcinogenesis data as it exists, the weak mutagenicity, the manner of excretion and the innocuous nature of the contaminants of 2,4-D discussed later do not suggest that this chemical should be carcinogenic, but we must await data presently being generated. Because carcinogenic activity has not been demonstrated, the question of the relation between exposure and genetic risk is not calculable.

Hazard Assessment

Almost all data from measurements of occupational exposure has been generated in studies of 2,4-D and 2,4,5-T applications. The most heavily exposed workers, mixer-loaders for aircraft applicators and backpack sprayers, may expect maximum doses of about 0.1 mg/kg.

The exposure of a person standing at the downwind edge of the buffer zone would be 0.1 mg/ft^2 of uncovered surface. At 4 lb/acre and 2 ft^2 of surface accessible, a contacted dose may be as much as 0.08 mg or 0.0016 mg/kg.

Respiratory exposure is not significant.

The same deposition rate in a stream 6 inches deep could result in a theoretical concentration of about 30 ppb. Two liters would contain 50 micrograms of 1.2 micrograms/kg (0.0012 mg/kg) for a 50 kg person. Deeper water would lower the dose accordingly. The known rapid adsorption of chemical to water sediment is not considered.

There is considerable data on uptake of 2,4-D by fish. Generally, levels of 2,4-D in edible tissues are lower than the ambient water concentrations. Eligehausen et al. (1980) maintained catfish for 4 days at about 0.01 ppm 2,4-D and found that the concentration of 2,4-D in whole fish rose to a level of 0.004 ppm over the 4-day period. At 2 days this concentration was only 0.0025 ppm. The concentration factor was 0.4. Sikka et al. (1977) similarly found that in water containing 2 ppm 2,4-D dimethylamine salt, bluegills accumulated 0.071 ppm in edible tissue in 6 hours, and catfish accumulated 0.17 ppm. In both cases, tissue levels remained relatively constant through 168 hours of continuous exposure. The concentration factors were about 0.04 and 0.1, respectively. Rogers and Stalling (1972) maintained trout, bluegill and catfish in 0.3 and 1.0 ppm 2,4-D butoxyethanol ester, in both fasted and fed states. Muscle residues ranged from three to six times water concentration in trout at 3 hours. In catfish the concentration factors were as high as 15 and in bluegill about 5-7 at 1 hour after exposure began; after 2 hours the concentrations decreased rapidly. This ester of 2,4-D is relatively fat soluble, and while it hydrolyses to 2,4-D relatively quickly, it survives long enough to accumulate briefly.

The treatments of concern here are with water soluble forms. If a concentration factor of 1 is assumed, 0.5 kg of fish would contain 15 micrograms 2,4-D, which would provide a dose of 0.0003 mg/kg.

Game that had browsed on treated foliage might reach tissue concentrations of 0.4 ppm. A half kilogram of such meat would deliver a dose rate of about 0.004 mg/kg.

Residues on berries and mushrooms just outside the target zone should not exceed 0.1 ppm after aerial application, which would result in a maximum dose of 0.5 micrograms (0.0005 mg)/kg/day from consumption of 0.25 kg of berries or mushrooms daily.

Ground application to within 10 feet of boundaries and "hack and squirt" treatment should not contaminate off-site vegetation.

A minimum safety factor for maximum exposure to applicators would be based on the reproductive no-observed-effect level of 20 mg/kg/day. The maximum dose of 0.1 mg/kg would be 1,200th of the no-effect dose.

The maximum environmental exposure resulting from off-site contamination could result from consumption of 0.5 mg of deer meat. The prospective dose would be 0.004 mg/kg/day which is 5,000 fold less than the reproductive no-effect dose.

The weak mutagenic effect and absence of demonstrated carcinogenic effect do not permit calculation of probability that genetic effects will result from exposure to 2,4-D.

2,4-D Contaminants

In the case of 2,4-D, special attention must be paid to two contaminants, one of which is also a metabolic product in microorganisms. The issue arises not because of data indicating hazard but because of allegations based on incorrect evaluation of the data.

In the manufacture of 2,4-D, 2-4-dichlorophenol (2,4-DCP) is an intermediate, some of which remains in the final product. Because of its low toxicity, it has not been judged necessary to completely eliminate it from the formulation. A paper published in 1958 reported on a study of the cancer promoting potential of phenol and a large number of substituted phenols, among them 2,4-DCP. 2,4-DCP, at doses large enough to cause substantial mortality due to direct toxicity, was found to be, in the evaluation of the authors, a very weak promotor of skin tumors initiated by a very potent complete carcinogen (Boutwell and Bosch 1958). That finding has been converted, in direct contradiction to the interpretation of the authors, into an allegation that 2,4-DCP is a highly efficient promotor.

The contention has also been made that large amounts of 2,4-DCP resulting from breakdown of 2,4-D remain in the environment and are immediately accessible to humans and other species. 2,4-DCP is the immediate microbial breakdown product of 2,4-D, and it in turn is further oxidized by the same organisms. The rate function for each of the steps in this long series of oxidations is higher than the preceding step. In other words, breakdown becomes easier with each step. The products are not liberated for the most part, but remain captive in the microorganisms. 2,4-DCP is so volatile that if it were to escape it would immediately dissipate. It also has an exceedingly low olfactory threshold; very, very small amounts are detectable by smell. The result of these factors is that only applicators or others working directly with the material before it is applied have any significant opportunity for contact. At worst, such immediate contact is something less than 0.3 percent of the corresponding exposure to 2,4-D. (The eight makers of 2,4-D in the U.S. have subjected their products to analysis for 2,4-DCP. Total chlorophenols, of which 2,4-DCP is predominant, were about 0.3 percent in the most contaminated sample. Many contained no detectable chlorophenols. Other chlorophenols include 2,6-DCP and the 2-chloro-and 4-chlorophenols, all of which are minor contributors. (L. E. Warren, Dow Chemical Co., personal communication.) If a figure must be assigned, exposure may be estimated in the worst case at about 0.003 mg/kg.

Environmental exposure will not correspond to the amount of 2,4-D applied, either as a fixed fraction of impurity, or as a fraction of applied and degraded 2,4-D. As an impurity, 2,4-DCP has a very high vapor pressure, so it evaporates and disappears quickly. As a metabolite of soil organisms, it is almost entirely entrained in those organisms, although at high levels of 2,4-D in water some DCP can be found. Environmental exposure to 2,4-DCP is so low it cannot be quantitated.

The toxicity of 2,4-DCP is very low. Chronic (6 months) treatment of mice at 0.1 percent (1,000 ppm) of the total diet produced no effects of any kind other than a slight liver enlargement (Kobayashi et al. 1972). The lethal dose is on the order of 10 times greater than that of 2,4-D.

The skin tumor promotion study by Boutwell and Bosch utilized a twice weekly application of 20 percent 2,4-DCP in benzene as solvent, to an area already treated with a potent carcinogen. The individual dose of 2,4-DCP was 5 mg/mouse twice weekly. The dose at each application was approximately 200 mg 2,4-DCP/kg at each treatment. This is not an excessive amount relative to the acute toxicity (LD_{50}) of 2,4-DCP, which in

mice is about 1,300 mg/kg, but over the 30 weeks of twice weekly treatment it resulted in the death of many animals. It is customary in carcinogenesis studies to set the maximum dosage at a level that produces no significant non-tumorigenic pathology, and causes no greater than 10 percent weight loss of the subjects. Because of the great skin damage and the mortality rate of the animals, the Boutwell-Bosch study does not qualify as a valid carcinogenesis study.

The important relationship is the amount of 2,4-D necessary to carry that amount of 2,4-DCP. At a concentration of 0.3 percent, intake of 67,000 mg 2,4-D per kg twice weekly for 39 weeks would be necessary to simulate the exposure. The worst case applicator exposure is about 0.1 mg 2,4-D/kg, and the difference is so great that 2,4-DCP is not a calculable component of the 2,4-D hazard potential.

The other impurity is, 2,7-dichloro dibenzo-p-dioxin (DCDD) which differs only slightly in structure from the well known 2,3,7,8 TCDD, but differs by about a million fold in toxicity. Two concerns of biological danger have been expressed; DCDD has been alleged to be a teratogen, and it is alleged to be carcinogenic.

DCDD has been found in 3 of 30 samples of US-produced 2,4-D, along with traces of other relatively nontoxic chlorodioxins with three and four chlorines. The concentrations in the three positive samples ranged between 25 and 60 ppb. If the maximum expected human dose of 2,4-D is 0.1 mg/kg and for convenience it is assumed that all 2,4-D contains 100 ppb of DCDD, the dose to the exposed human would be 0.00000001 mg/kg.

The toxicologic studies from which these concerns arise are reported by Khera and Ruddick (1973) who discuss fetotoxic effects of DCDD, and the National Cancer Institute, which conducted carcinogenesis studies in two species. In the Khera and Ruddick study, DCDD was fed at doses of 1 and 2 mg/kg daily, to ascertain whether DCDD was capable of causing birth defects. The observed effect at 1 mg/kg was a modest degeneration of heart muscle fibers and some fluid accumulation around the heart in a few of the animals, and a somewhat greater number of affected animals at 2 mg/kg. Both effects are in the category of general fetal toxicity. No teratogenic effect was found.

The National Cancer Institute work was carried out by feeding DCDD as 0.5 and 1 percent of the total diet for 2 years. The data indicated a "suggested" carcinogenic effect in male mice that was not strong enough to support a conclusion that DCDD is a carcinogen. Male mice, and rats of both sexes, did not show [illegible] significant response.

These observations may be considered in terms of actual 2,4-D exposure, or in terms of the amount of 2,4-D necessary to deliver the DCDD used in the studies.

The 1 mg/kg dose of DCDD used in the Khera and Ruddick (1973) work is 100,000,000 times greater than the dose that would accompany a 0.1 mg/kg dose of 2,4-D. If 1 mg of DCDD/kg were delivered in 2,4-D at 100 ppb, the dose of 2,4-D would be on the order of 10 kg/kg body weight, or for a 150 lb person, 3/4 ton of 2,4-D.

The 1 percent diet to mice delivered a still greater relative amount. A 25 gram mouse consumes about 5 grams of feed daily. At 1 percent of the diet, this is about 50 mg DCDD/mouse or 2,000 mg/kg daily for life, about 200 billion times more than the expected maximum occupational exposure. At 100 ppb contamination level, the 2,4-D intake necessary to deliver this amount would be 20,000 kg (20 metric tons) 2,4-D/kg. For a 50 kg person this is well in excess of the national capacity to manufacture the herbicide.

The conclusion must be that neither 2,4-DCP, nor 2,7-DCDD, at maximum occupational or environmental exposures to 2,4-D, represent a hazard to humans.

Common Name: Diesel Oil

Major Applications in Forestry: Used as carrier for herbicides

Summary

Diesel oil wets plant surfaces and spreads as a thin film over leaf surfaces. It penetrates plants easily because oil has a very low surface tension compared to aqueous solutions. Oil moves into intercellular spaces and may interfere with translocation of metabolic products and nutrients in the plant as well as carry the herbicide into the plant structure.

Very few studies have been conducted on the fate of diesel fuels in terrestrial or freshwater environments. Losses from soils depend primarily on microbiodegradation and leaching. Aliphatic hydrocarbons are usually adsorbed to soils and do not readily leach. Effects in water depend on how much photoxidation of the surface film occurs and the quantities of fuel oil which adsorb to suspended particulates and sink to the stream bed.

Impacts on animals by ingestion are minimal due to the repulsive nature of diesel oil. Diesel oil can prevent hatching of bird eggs and can have detrimental effects on aquatic birds. LD_{50} values are so high that dosages found in the forest environment could be considered insignificant.

Appendix G Relationship of Areawide Clearinghouses to BLM Districts

BLM District	Areawide Clearinghouses	County
Salem:	Clatsop-Tillamook Intergovernmental Council	Clatsop Tillamook
	Metropolitan Service District	Clackamas Multnomah Washington
	Mid-Willamette Valley Council of Governments	Marion Polk Yamhill
	District 4 Council of Governments	Benton Lincoln Linn
	Lane Council of Governments	Lane
Eugene:	District 4 Council of Governments	Linn
	Lane Council of Governments	Lane
	Umpqua Regional Council of Governments	Douglas
Roseburg:	Lane Council of Governments	Lane
	Umpqua Regional Council of Governments	Douglas
Coos Bay:	Umpqua Regional Council of Governments	Douglas
	Coos-Curry Council of Governments	Coos Curry
Medford:	Umpqua Regional Council of Governments	Douglas
	Coos-Curry Council of Governments	Coos Curry
	Rogue Valley Council of Governments	Jackson Josephine
	Klamath Lake Planning and Coordinating Council	Klamath

Appendix H Descriptions of Major Soil Orders of Western Oregon

Xeric Soils of Moderate Rainfall Western Oregon Region

Mollisols, Alfisols, Vertisols and Ultisols of Valley

Soils of the Willamette Valley floodplain and terraces are dominantly deep, silty, moderately dark and somewhat acid. Poorly-drained soils are common. Soils of the southwestern valleys are generally less silty, more variable in depth and lighter-colored, although dark clay Vertisols are common. Reddish, strongly-leached Ultisols occur on older terraces and footslopes.

Alfisols, Ultisols, Inceptisols, Mollisols and Vertisols of Foothills and Mountains

These uplands have a pronounced dry period. The soils are highly variable but mostly dark at the surface, clayey and moderately acid in the north, becoming lighter-colored, less acid and less clayey in the south.

Udic Soils of High Rainfall Western Oregon Regions

Spodosols, Inceptisols and Entisols of Valleys and Coastal Lowlands

These soils are strongly acid, mainly dark and deep. Poorly-drained, clayey soils are common in the stream valleys and estuaries. Gravelly soils predominate in western Cascade valleys. Sandy Spodosols, commonly with iron-cemented subsoils, occur on lower coastal terraces; Entisols on younger dunes.

Inceptisols and Ultisols of the Coast Range and Western Cascade Mountains

These areas are steep and heavily forested. The soils are mostly dark, loamy or clayey. Shallow, stony soils are common with deeper, reddish, clayey Ultisols on smoother, more stable slopes.

Inceptisols, Alfisols and Ultisols of the Western Klamath Mountains

These soils are dominantly light-colored, medium to slightly acid, loamy, and commonly stony and shallow. Granitic areas have sandy soils, and serpentine areas have mostly shallow, reddish, clayey soils.

Inceptisols, Spodosols and Entisols of High Mountains

Soils of the forested higher elevations are mostly dark, moderately to strongly acid, shallow and stony. Light-colored, coarse-textured Entisols and Spodosols occur on glacial deposits.

Xeric Soils of Moderate Rainfall Eastern Oregon Forested Regions

Mollisols and Inceptisols of the Mountains

Soils of the mountainous lava plateaus are mostly dark, moderately to slightly acid, loamy, moderately deep or shallow and stony. Tuffaceous bedrock areas have clayey soils. Light-colored, silty Inceptisols from volcanic ash occur on broad plateaus and northerly slopes.

Source: Loy et al. 1976

Appendix I BLM-Administered Lands in Municipal Watersheds

Water District	Water Supply Source	BLM Acres In Watershed
Albany	South Santiam River	34,304
Alsea	North Fork Alsea River	17,984
Canby	Molalla River	40,320
Canyonville	O'Shea Creek	2,309
Canyonville	West Fork Canyon Creek	5,840
Carlton	Panther Creek	1,300
Cave Junction	Illinois River	21,713
Central Point	Rogue River	160,211 [1]
Cherry Grove	Tualatin River	1,198
Cherry Grove	Trask River	571
Clackamas	Clackamas River	14,080
Colton	Jackson Creek	530
Corbett	Gordon Creek	2,720
Corvallis	Chintimini Creek	40
Dallas	Rickreall Creek	2,816
Drain	Bear Creek	640
Drain	Allen Creek	280
Eagle Point	Rogue River	160,211 [1]
Estacada	Clackamas River	5,312
Eugene/Springfield	McKenzie River	14,760
Falls City	Teal Creek	480
Forest Grove	Tualatin River	1,198
Forest Grove	Trask River	571
Gates	North Santiam River	2,752
Gleneden Beach	Drift Creek	2,048
Gold Hill	Rogue River	188,852
Grants Pass	Rogue River	279,911
Hillsboro	Tualatin River	1,198
Hillsboro	Trask Rivers	571
Jacksonville	Rogue River	160,211 [1]
Kernville	Drift Creek	2,048
Lake Oswego	Tualatin River	1,198
Lake Oswego	Trask River	571
Laurelwood	Tualatin River	1,198
Laurelwood	Trask River	571
Leaburg	Middle Fork Willamette River	600 [2]
Lebanon	South Santiam River	34,304
Lincoln Beach	Drift Creek	2,048
Lyons	North Santiam River	18,944
McMinnville	Nestucca River	920
McMinnville	Haskins Creek	not calculated
Medford	Rogue River	160,211 [1]
Mill City	North Santiam River	3,592
Milwaukie	Clackamas River	14,080
Molalla	Molalla River	36,570
Monmouth	Teal Creek	480
Myrtle Creek	North Myrtle or Bilger Creek	190

Water District	Water Supply Source	BLM Acres In Watershed
Northwood Acres	Unnamed Creek	10
Oregon City	Clackamas River	14,080
Panther Creek	Panther Creek	40
Philomath	Chintimini Creek	40
Portland	Bull Run River	70
Riddle	Russell Creek	1,999
Salem	North Santiam River	18,944
Sandy	Alder Creek	480
Scappoose	Gourley Creek	600
Scappoose	Lazy Creek	384
Scappoose	South Scappoose Creek	1,632
Seal Rock	Tangeman Creek	10
Seal Rock	Siletz River	17,004
Sheridan	East Fork Willamina Creek	50
Siletz	Tangeman Creek	10
Siletz	Siletz River	17,004
Silverton	Abiqua Creek	1,792
Silverton	Silver Creek	200
Stayton	North Santiam River	18,944
Sweet Home	South Santiam River	29,584
Talent	Wagner Creek	2,800
Toledo	Tangeman Creek	10
Toledo	Siletz River	17,004
Valsetz	Fanno - Handy Creeks	240
Waldport	West - Eckman Creeks	80
Willamina	Willamina Creek	16,192
Yamhill	Turner Creek	56

[1] Supplemental source used in the summer.

[2] Development of this water supply is planned for the near future.

Appendix J Herbicide Analyses of Streamflow Samples

The following table presents the only available water quality data on background levels of herbicides in western Oregon streams. The data was obtained from the U.S. Geological Survey's computer file for water data storage and retrieval (WATSTORE). It represents herbicide concentrations in streamflow samples collected randomly in time, not in conjunction with specific activities in the watersheds.

	Total 2,4-D (micrograms/1)[1]	Total 2,4,5-T[2] (micrograms/1)
Station No. 14191000 - Wilamette River at Salem, Oregon		
Mar 22, 72	ND[3]	ND
Jan 17, 73	ND	ND
Mar 1, 73	ND	.01
Jun 26, 73	.02	.01
Sep 19, 73	ND	ND
Station No. 14207500 - Tualatin River at West Linn, Oregon		
May 27, 76	ND	ND
Aug 20, 76	ND	ND
Nov 23, 76	ND	ND
Feb 16, 77	ND	ND
Jun 1, 77	ND	ND
Sep 6, 77	ND	ND
Dec 2, 77	ND	ND
Feb 17, 78	ND	ND
May 16, 78	ND	ND
Nov 8, 78	ND	ND
Station No. 14301000 - Nehalem River near Foss, Oregon		
May 26, 76	ND	ND
Aug 19, 76	ND	ND
Nov 22, 76	ND	ND
Feb 24, 77	ND	ND
Jun 2, 77	ND	ND
Sep 9, 77	ND	ND
Dec 1, 77	ND	ND
Feb 16, 78	ND	ND
May 15, 78	ND	ND
Aug 2, 78	ND	ND
Nov 7, 79	ND	ND
Station No. 14372300 - Rogue River near Agness, Oregon		
May 20, 76	ND	ND
Aug 18, 76	ND	ND
Nov 17, 76	ND	ND
Feb 24, 77	ND	ND
May 17, 77	ND	ND
Aug 24, 77	ND	ND
Nov 29, 77	ND	ND
May 17, 78	ND	ND
Aug 16, 78	ND	ND
Nov 14, 79	ND	ND
Station No. 14312260 - South Umpqua River near Roseburg, Oregon		
Oct 7, 69	ND	ND
Aug 6, 70	ND	.02
Oct 6, 70	ND	ND
Apr 27, 71	ND	ND
Jun 22, 71	ND	ND
Nov 23, 71	ND	ND
Feb 23, 72	ND	ND
Jun 29, 72	ND	ND
Aug 29, 72	ND	ND
Sep 21, 72	ND	.01
Oct 18, 72	ND	ND
Dec 29, 72	ND	ND
Feb 22, 73	ND	ND
Apr 19, 73	ND	ND
Jun 29, 73	ND	ND
Aug 30, 73	.02	.01
Nov 12, 73	ND	ND
Jan 9, 74	ND	ND
Feb 19, 74	ND	ND
Apr 17, 74	ND	ND
Jun 25, 74	ND	ND
Sep 5, 74	ND	ND
Oct 23, 74	ND	ND
Jan 29, 75	ND	ND
Jul 22, 75	ND	ND
Oct 22, 75	ND	ND
Jan 22, 76	ND	ND
Apr 16, 76	ND	ND
Jul 22, 76	.01	ND
Oct 20, 76	ND	ND
Jan 6, 77	ND	.09
Apr 20, 77	ND	ND
Jul 26, 77	.05	.04
Oct 27, 77	ND	.03
Jan 25, 78	ND	ND
Apr 20, 78	ND	.01
Aug 14, 78	.04	ND
Oct 23, 78	ND	ND
Jan 23, 79	ND	ND
Apr 23, 79	.02	.01
Aug 30, 79	.05	.01
Jan 15, 80	ND	ND
Apr 14, 80	ND	ND
Aug 12, 80	ND	ND
Oct 14, 80	ND	.01
Feb 3, 81	.02	ND
Apr 20, 81	ND	ND
Oct 6, 81	.03	.02
Feb 4, 82	ND	ND

[1] A microgram is one millionth of a gram.

[2] 2,4,5-T is not being evaluated under this EIS. 2,4-D and 2,4,5-T sampling data are presented here because data on other herbicides are not available.

[3] ND signifies specifically looked for but not detected.

Appendix K Toxicity of Dioxins in Herbicides Proposed for Use

A significant amount of confusion exists because of the use and misuse of the term dioxin. The term can refer to any one of approximately 75 polychlorinated dibenzodioxins (PCDD), but to many people, it has become synonymous with 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-T4CDD), the only known dioxin with toxicity of any significance. The confusion has been compounded by free usage of the abbreviations DCDD (for dichlorodibenzodioxin) and TCDD (for tetrachlorodibenzodioxin). These are groups of compounds, there being 22 tetrachlorodibenzodioxins, and each compound acts differently in the environment. Common usage of the term TCDD to mean 2,3,7,8-tetrachlorodibenzo-p-dioxin has caused some readers to assume all TCDDs are of the same toxicity, which is not the case. For example, 2,4-D studies have identified traces of several dichloro-, trichloro- and tetrachlorodibenzo-p-dioxin impurities, but none are thought to be particularly toxic (NRCC 1981). Recent Studies such as the 1981 Candian publication *Polychlorinated Dibenzo-p-Dioxins: Criteria for their Effects on Man and His Environment*, refer to each specific PCDD by name, which alleviates much of the confusion.

It is important to recognize that manufacturing processes have been refined over the past few years to reduce impurities, with good success. A trade memorandum from Agriculture Canada's Food Production and Inspection Branch dated August 28, 1981, stated, "Through this review, it has been possible to identify certain technical products that can be expected to be virtually free of PCDDs" (NRCC 1981).

Of the herbcides proposed for use under this EIS, only 2,4-D has been found to contain dioxins, and these dioxins are practically non-toxic (NRCC 1981). The following discussions have been extracted and included herein for clarification. The term TCDD used in the extracts refers specifically to 2,3,7,8-T4CDD.

Extract from Newton and Dost 1981, pg. 28:
Impurities occur in many organic synthesis procedures. Dioxins are among the trace impurities in all the phenoxys. There are 75 chlorinated dibenzodioxins, of which many occur in the chlorinated phenols and products made from them. Three dioxins have been found in 2,4-D, of which all are of limited toxicity. The initial finding of chlorodioxins in 2,4-D of Canadian manufacture (Cochrane et al. 1980) showed substantial levels in certain formulations. U.S. EPA immediately assayed 30 formulations manufactured in the U.S. and in 3 samples found traces of 2,7-dichlorodibenzo-p-dioxin, the species to be expected in 2,4-D manufacture. No sample contained more than 60 ppb, which does not represent a toxicologic concern.

Extract from USDE, BPA 1981, pg. A-143:
Chlorodibenzodioxins other than TCDD are of less concern because of low toxicity. Schwetz et al. (1973) reported that 2,4-dichlorodibenzo-p-dioxin and octachlorodibenzo-p-dioxin have low toxicity, whereas TCDD was extremely toxic. Low dosages of TCDD (0.0005 to 0.001 mg/kg/day) were toxic to rats, whereas 1,2,3,4-tetrachlorodibenzo-p-dioxin, 2,7-dichlorodibenzo-p-dioxin, 2,3-dichlorodibenzo-p-dioxin, and 2-chlorodibenzo-p-dioxin at dosages up to 2 mg/kg/day had little or no effect (Khera and Ruddick 1973).

2,4-D is synthesized from 2,4-dichlorophenol and, therefore, does not contain TCDD (see Bovey and Young 1980). Three other chlorodibenzodioxins of low toxicity have been found in 2,4-D manufactured in Canada (Cochrane et al. 1980). Analysis of 30 U.S. samples of 2,4-D revealed 2,7-dichlorodibenzo-p-dioxin in three formulations. No sample contained more than 60 ppb of 2,7-dichlorodibenzo-p-dioxin, which does not represent a toxicologic concern (Newton and Dost 1981). As part of the National Cancer Institute bioassay program, a 2-year feeding study was conducted. Male and female rats and mice were fed 10,000 ppm (10,000,000 ppb) 2,7-dichlorodibenzo-p-dioxin. The panel of the National Cancer Institute concluded that 2,7-dichlorodibenzo-p-dioxin was not a carcinogen.

Glossary of Terms

Adsorption - Adhesion of substances to the surfaces of solids or liquids. Technically, the attraction of ions of compounds to the surfaces of solids or liquids.

Air Contaminant - An unnatural component of air.

Air Pollutant - Either an air contaminant that represents a hazard to human health or a natural component of air present in sufficient quantity to create such a hazard.

Allowable Cut - The amount of timber that may be harvested annually or periodically from a specified area over a stated period in accordance with the objectives of management.

Allowable Cut Determination Process - The development and evaluation of alternative levels of timber production for the purpose of establishing an allowable cut.

Archeological Resources - All evidences of past human occupations other than historical documents, which can be used to reconstruct the lifeways of past peoples. These include sites, artifacts, environmental data and all other relevant information. Archeological resources are also called cultural resources.

Area of Critical Environmental Concern (ACEC) - An area within the public lands where special management attention is required (when such areas are developed or used, or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards (FLPMA Sec. 103(a)).

Average Employment - The sum of number of employees, reported monthly, divided by twelve; because employment is reported for all employees working during any one month, it is a modest over-estimate of full-time equivalent employment.

Board Foot - A unit of solid wood, 1 foot square and 1 inch thick.

Broadcast Burning - Intentional burning in which fire is intended to spread over all of a specific area. It may or may not qualify as prescribed burning.

Brush-Seedling Stage - A successional stage in the development of a forest where vegetation is dominated by brush and/or tree seedlings.

Buffer Strip - A protective area adjacent to an area requiring special attention or protection. In contrast to riparian zones which are ecological units, buffer strips can be designed to meet varying management concerns.

Bureau Planning System - A process used in the BLM to establish land use allocations, constraints and objectives for various categories of public land use.

Carcinogenic - A substance producing or inciting cancer.

Characteristic Landscape - The existing visual character of an area of land. The term does not necessarily mean naturalistic landscape character. It can refer to farmlands, timberlands or another type of landscape.

Chemical Degradation - The breakdown of a chemical substance into simpler components through chemical reactions.

Clearcutting - A method of timber harvesting in which all trees (merchantable or unmerchantable) are cut from an area.

Commercial Forest Land - Forest land that is now producing or is capable of producing at least 20 cubic feet per acre per year of commercial coniferous tree species.

Coos Bay Wagon Road (CBWR) Lands - Public lands granted to the Southern Oregon Company and subsequently reconveyed to the United States.

Covered Employment (Payroll) - Employees and payroll covered by either the Oregon Unemployment Insurance Law or the program of Unemployment Compensation of Federal Employees.

Critical Habitat - (1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Endangered Species Act, on which are found those physical or biological features (i) essential to the conservation of the species and (ii) which may require special management considerations or protection, and (2) specific areas outside the geographical area occupied by the species at the time it is listed upon the determination by the Secretary that such areas are essential for the conservation of the species.

Cryic Soil Temperature Zone - A soil temperature regime used in soil classification. Generally, these soils have mean annual temperatures between 32° F and 47° F.

Cultural Modifications - Man-caused alterations of the landscape.

Cultural Resources - Those fragile and nonrenewable remains of human activity, occupation, or endeavor, reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features, that were of importance in human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred --even though evidence of the event no longer remains, and (3) the environment immediately surrounding the actual resource. Cultural resources, including both prehistoric and historic remains, represent a part of the continuum of events from the earliest evidences of man to the present day.

Decision Document - A document issued subsequent to environmental analysis identifying the decisions made concerning a proposed action, the rationale used in making the decisions and the environmental considerations used in the decisionmaking.

Defoliation - A reduction in the amount of leaves or needles due to the application of vegetation management treatments, specifically herbicides.

Demographic Analysis - A statistical evaluation of a human population with regard to size and density, distribution and vital statistics.

Designated Area - Principal population centers of western Oregon which have been established in consultation with the Oregon Department of Environmental Quality.

Dispersed Recreation - Pleasure-seeking activities which may occur over wide areas. Density of use is normally low, and facility developments are nonexistent.

Dissolved Solids - Material dissolved in water; usually refers to material in a water sample which passes through a 0.45 mm membrane filter.

Distance Zone - Distance (viewing) zones are subdivisions of public lands which specify the distances between observer and observed areas. In the VRM inventory process, there are three distance zones: foreground-middleground, background and seldom-seen. Areas seen from highways, rivers, scenic overlooks or other viewing locations which are less than 5 miles away are in the foreground-middleground zone. Seen areas beyond the foreground-middleground but less than 15 miles away are in the background zone. Areas not seen as foreground-middleground or background are categorized seldom-seen.

DNA - Deoxyribonucleic acid. Any of various nucleic acids that are the molecular basis of heredity in many organisms.

Drip Torch - A container of slash-burning fuel equipped with a wick to ignite the fuel mixture as it drips from the container onto the slash. Hand-held torches have a 1-1/2-gallon capacity, and ignition is accomplished using a fiber-filled, fuel-soaked wick. The torch used by a helicopter has a 30-55-gallon capacity and is equipped with an electrically activated fuel pump and ignition.

Droughty Soil - A soil that, due to its internal characteristics, provides limited plant food and moisture.

Dry Ravelling - The downslope movement of detached soil, debris or gravel.

Duff - Forest litter and other soil organic debris in various stages of decomposition located on top of the mineral soil.

Edge - The place where plant communities meet or where successional stages of vegetation conditions within plant communities come together.

Endangered Species - Plant or animal species that are in danger of extinction throughout all or a significant portion of their range.

Environmental Assessment (EA) - A systematic environmental analysis of site-specific BLM activities used to determine whether such activities have a significant effect on the quality of the human environment and whether a formal environmental impact statement is required.

Environmental Impact Statement (EIS) - A formal document to be filed with the Environmental Protection Agency that considers significant environmental impacts expected from implementation of a major Federal action.

Erosion (soil) - Removal of soil from its place of origin to a point of deposition other than a stream channel.

Escape Cover - Generally, any vegetation, rocks or logs used by fish for security or escape from danger.

Evapotranspiration - The process which returns soil moisture to the atmosphere, including evaporation and plant transpiration (uptake of soil water through roots and loss of water through leaves or needles).

Even Flow - Maintaining a relatively constant, undiminishing supply of timber from year to year for the planning cycle.

Fetotoxin - A substance that through its chemical action can kill or injure unborn human or animal offspring.

First Order Stream - A small, unbranched tributary.

Forbs - Herbaceous plants; most often used pertaining to herbaceous plants eaten by wildlife.

Forest Land - Land that is now, or is capable of becoming, at least 10 percent stocked with forest trees and that has not been developed for nontimber use.

Frigid Soil Temperature Zone - A soil temperature regime used in soil classification. It is similar to the cryic temperature zone, but the mean summer temperature is warmer (see Cryic Soil Temperature Zone).

Gelled Gasoline - A slash-burning fuel mixture containing an aluminum soap of fatty acid (Alumagel) and gasoline. This gelling additive is mixed with gasoline at the rate of 7 pounds per 35 gallons.

Grass-Forb Stage - A successional stage in the development of a forest where vegetation is dominated by grass and forbs. Conifer seedlings may also be present.

Gross Timber Volume - The total volume present in a stand without deduction for defects or anticipated logging damage.

Gross Yarding - Removal from a logging unit of most large tree materials (generally all logs greater than 8 inches in diameter and at least 8 feet in length).

Groundwater - Subsurface water in the zone of saturation.

Habitat - The environment in which an organism occurs.

Hiding Cover - Vegetation capable of hiding 90 percent of a standing adult deer or elk from the view of a human at a distance equal to or less than 61 meters (200 ft.). Generally, any vegetation used by deer or elk for security or escape from danger.

Historic Resources - All evidences of human activity that date from historic (i.e., recorded history) periods. These resources include documentary data (i.e., written records, archival material, photographs, maps, etc.), sites, artifacts, environmental data, and all other relevant information. Also included are locations where documented historical events took place, even though no physical evidence of the events remains other than the setting. Historic resources are cultural resources and may be considered archeological resources when archeological work is involved in their identification and interpretation.

Hypothermia - A condition of subnormal body temperature caused by exposure to cold.

IMPLAN - An economic input-output model maintained by the U.S. Forest Service on the U.S. Department of Agriculture's Fort Collins Computer Center. An input-output table specific to the eighteen county region described in this EIS was built in June 1982. A copy of the output and the multipliers is avaliable at the Eugene BLM District Office.

In-lieu Property Tax - Federal land is exempt from property taxes levied by local jurisdictions. To compensate, the Federal government shares revenue with State and sometimes local governments instead (in-lieu) of making property tax payments.

Instream Structure - Boulders and large stable woody debris which create pools and trap spawning gravel. Extensively used by fish for security or escape from danger.

Integrated Pest Management (IPM) - Use of several techniques (e.g. burning, grazing and mechanical, manual or chemical methods) as one system to gain control of animals or plants existing in areas where they are unwanted (see BLM Manual 9220).

LC_{50} - A lethal concentration rate at which 50 percent of the test animals will be killed. It is usually used in testing of fish or other aquatic animals.

LD_{50} - The dosage of toxicant, expressed in milligrams of toxicant per kilogram of animal body weight, required to kill 50 percent of the animals in a test population when given orally.

Leach - Usually refers to the movement of chemicals through soil by water; may also refer to movement of herbicides out of leaves, stems or roots into the air or soil.

Lumber and Wood Products, except Furniture - Defined by the Office of Management and Budget and the Standard Industrial Classification Manual as Major Group #24, which includes logging contractors engaged in cutting timber and pulpwoods; merchant sawmills, lath mills, shingle mills, planing mills, plywood mills, and veneer mills engaged in producing lumber and wood basic materials; and establishments engaged in manufacturing finished articles made entirely or mainly of wood or wood substitutes. Certain types of establishments producing wood products are classified elsewhere, e.g., furniture and office and store fixtures are classified in Major Group #25.

Management Framework Plan (MFP) - Land use plan for public lands which provides a set of goals, objectives and constraints for a specific planning area to guide the development of detailed plans for the management of each resource.

Merchantable Volume - That portion of the gross timber volume (less deduction for defects and anticipated logging damage) which is suitable for marketing. Given the same gross timber volume, a stand consisting of many small trees will contain less merchantable volume than a stand consisting of fewer large trees.

Metabolism - The chemical changes in living cells by which energy is provided for vital processes and new material is assimilated.

Metabolite - A product of the chemical changes in living cells which provide energy and assimilate new material.

Microbial Degradation - The breakdown of a chemical substance into simpler components by bacteria.

Microclimate - The climatic condition of a small area modified from the general climatic conditions by local differences in elevation or exposure.

Microgram - One millionth of a gram.

Mineralizable Nitrogen - A soil nutrient used as an index of forest soil fertility and site productivity.

Mutagen - A substance that tends to increase the frequency or extent of genetic mutations (changes in hereditary material).

National Register of Historic Places - The official list, established by the Historic Preservation Act of 1966, of the nation's cultural resources worthy of preservation. The Register lists archeological, historic, and architectural properties (i.e., districts, sites, buildings, structures, and objects) nominated for their local, State, or national significance by State and/or Federal agencies and approved by the National Register staff. The Register is maintained by the National Park Service.

Natural Levels - Amount of pollutants present from natural sources without human disturbances, which have reached equilibrium.

O&C Lands - Public lands granted to the Oregon and California Railroad Company and subsequently revested to the United States.

Outstanding Natural Areas - Areas of outstanding scenic splendor, natural wonder or scientific importance that merit preservation in their natural condition. The preservation of these resources in their natural condition is the primary management objective. Access roads, parking areas and public use facilities are normally located on the fringe of the area. The public is encouraged to walk, rather than drive, into the area for recreation purposes wherever feasible.

Paleontology - A science dealing with the life of past geological periods as known from fossil remains.

Particulates - Finely divided solid or liquid particles in the air or in an emission; includes dust, smoke fumes, mist, spray and fog.

Peak Flow - The highest amount of streamflow or riverflow occurring in a year or during a single storm event.

Personal Income - Income received by all individuals in the economy from all sources; made up of wage and salary disbursements, proprietors income, rental income of persons, dividends, personal interest income, and the difference between transfer payments and personal contributions for social insurance.

Photodecomposition - The breakdown of a substance, especially a chemical compound, into simpler components by the action of radiant energy.

Photosynthesis - Formation of carbohydrates in the tissues of plants exposed to light.

Plant Community - An association of plants of various species found growing together in different areas with similar site characteristics.

Planning Area Analysis - Documentation of the existence and significance of economic, social, infrastructure, institutional and environmental values, and the establishment of economic demand projections, within a planning area.

Plantation Maintenance - For purposes of this EIS, any vegetation management action taken after planting to promote the survival and establishment of trees. Treatments may include use of biological, mechanical, or manual weeding, mulching, herbicides or a combination of methods.

Precommercial Thinning - Cuttings made in immature stands (10-25 years) in order to stimulate the growth of trees by increasing available soil moisture and nutrients. Such cuttings decrease the time needed to reach merchantable size and increase total merchantable yields from the stand.

Prehistoric - Pertaining to that period of time before written history.

Public Lands - Any land and interest in land owned by the United States within the several States and administered by the Secretary of the Interior through the Bureau of Land Management. May include public domain, O&C or acquired lands in any combination.

Public Domain Lands - Original holdings of the United States never granted or conveyed to other jurisdictions.

Recreation Experience - The expected or desired psychological and physiological outcomes from engaging in a specific recreation activity within a specific setting.

Recreation Opportunity - The opportunity for a person to engage in a specific recreation activity within a specific setting to realize a predictable recreation experience.

Recreation Site - A recreational development on a relatively small, distinctively defined parcel of BLM-administered land. Sites have facilities (e.g., roads, parking space, litter cans, tables, restrooms, waste water sumps, barbeque pits) designed primarily to accommodate camping and/or picnicking.

Reforestation - Reestablishment of a tree crop on forest land.

Regeneration - The renewal of a commercial tree crop, whether by natural or artificial means; also, the young crop itself.

Release - Any action taken on an established commercial timber stand to control stand composition and promote dominance and/or growth of suitable tree species. Treatments may include mechanical or manual slashing of undesirable brush and tree species, herbicides, biological control or a combination of methods. Forest fertilization is not considered a release treatment.

Research Natural Areas - Areas established and maintained for research and education. The general public may be excluded or restricted where necessary to protect studies or preserve research natural areas. Lands may have: (I) Typical or unusual faunistic or floristic types, associations, or other biotic phenomena, or (2) characteristic or outstanding geologic, pedologic or aquatic features or processes.

Riparian Habitat - Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables and soils which exhibit some wetness characteristics. Includes riparian zones plus one-half the transition zone (or ecotone) between riparian zones and upland habitat (Instruction Memo OR-08-243).

Riparian Zone - An area identified by the presence of vegetation that requires free or unbound water or conditions more moist than normally found in the area (Instruction Memo OR-08-243).

Runoff - That part of precipitation, as well as any other flow contributions, which appears in surface streams, either perennial or intermittent.

Scalping - The removal of live vegetation, roots and/or slash to expose an area of mineral soil suitable for planting. This work is usually performed using a hand-held hoe or shovel-like tool.

Scarification - The dislodging of root systems of brush and/or hardwood species and removing surface vegetation. This work is usually accomplished using a tractor with a special blade. Scarification often includes piling or windrowing of slash, brush and unmerchantable trees.

Scenic Quality - A measure (A, B or C) of the aesthetic appeal of an area of land. Scenic quality is determined by an interdisciplinary team of evaluators using standard Bureau criteria (BLM Manual 8400).

Scribner - A log rule commonly accepted in the EIS area used to determine the board foot volume contained in a log.

Sclerophyllous Species - Evergreen shrub and tree species characterized by having thick, leathery leaves. These species are strong competitors with conifer seedlings on dryer sites of southwestern Oregon. Examples of these species include tanoak, madrone and ceanothus.

Scoping - The process by which significant issues relating to a proposal are identified for environmental analysis. Scoping includes eliciting public comment on the proposal, evaluating concerns and developing alternatives for consideration.

Second Order Stream - A stream formed by the joining of two small, unbranched tributaries.

Secondary Succession - An alteration of the natural plant succession of an area by fire, cultivation, logging, windthrow or any similar disturbance that destroys the principal species of an established community.

Sediment - Organic matter or soil that settles to the bottom of a liquid.

Sediment Yield - The quantity of sediment, measured in dry weight or by volume, transported in water flowing through a stream cross-section in a given time. Consists of both suspended sediment and bedload.

Sensitive Species - Species not yet officially listed but which are undergoing a status review or are proposed for listing according to Federal Register notices published by the Secretary of the Interior or Secretary of Commerce, or according to comparable State documents published by State officials. (Reference Instruction Memo W.O. 80-722.)

Sensitivity Level(s) - Estimates of levels of public concern for scenic quality. Sensitivity levels (high, medium, or low) are based upon standard Bureau criteria (BLM Manual 8400).

Seral (Successional) Stage - The relatively transitory plant communities within an orderly process of plant community change.

Severance Tax - A tax paid when timber is harvested or severed from the stump.

Silviculture - The art of producing and tending a forest.

Site Preparation - For purposes of this EIS, any action taken prior to reforestation efforts (natural or artificial) to create an environment which is favorable for survival of suitable trees during the first growing season. This environment can be created by altering ground cover, soil or microsite conditions; using biological, mechanical, or manual clearing; prescribed burning; herbicides or a combination of methods.

Slash - The branches, bark, tops, cull logs, and broken or uprooted trees left on the ground after logging has been completed.

Snag - A standing dead tree or partially dead tree from which some or all of the leaves and limbs have fallen. For management purposes, a snag is defined as any dead or partly dead tree at least 10.2 cm. (4 in.) dbh and at least 1.8 m. (6 ft.) tall.

Soil - The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil Order - The highest (most general) category in the U.S. soil classification system. All soils are differentiated into 1 of 10 soil orders.

Soil Productivity - The capacity of a soil in its normal environment to produce a specified plant or sequence of plants under a specified system of management.

Soil Series - The lowest (most detailed) category in the U.S. soil classification system.

State Historic Preservation Officer (SHPO) - The official within each State, authorized by the State at the request of the Secretary of the Interior, to act as a liaison for purposes of implementing the National Historic Preservation Act of 1966.

Stocking Surveys - Examination of planting sites either prior to first planting or following treatment. Survey is designed to identify any conditions which may limit the success of a reforestation project so corrective action can be taken.

Stocking Standards - A level of conifer seedling density which is to be achieved. In addition to achieving a desired number of trees per acre, these trees must be well-distributed throughout the plantable acreage.

Stratification - Arrangement of vertical layers of vegetation.

Stream Order - A system of stream classification. Each small unbranched tributary is a first order stream. Two first order streams join to make a second order stream. A third order stream has only first and second order tributaries, and so forth.

Succession - The orderly process of plant community change. Process by which one plant community will succeed another over time given the same climatic conditions.

Suspended Sediment - Sediment suspended in a fluid by the upward components of turbulent currents or by colloidal suspension.

Sustained Yield - The yield that a forest can produce continuously at a given intensity of management.

Sustained Yield Unit - An administrative division of the EIS area for which an allowable cut is calculated.

Target Stocking - A specific stocking standard which is the goal of BLM reforestation efforts in western Oregon. This standard is designed to obtain the desired number of well-spaced trees per acre at the age of first commercial thinning. Target levels assure that intermediate cuts will be realized through commercial thinning. Minimum stocking standards represent a lower (but acceptable) number of well-spaced trees per acre, but no intermediate cuts are anticipated. Below minimum stocking represents an unacceptable number of trees per acre.

Teratogen - A substance tending to cause developmental malformations in unborn human or animal offspring.

Texture (soil) - The relative proportion of sand, silt and clay (expressed as percentages) in a soil; grouped into standard classes and subclasses in the USDA Soil Survey Manual.

Thermal Cover - Cover used by animals to ameliorate effects of weather. For elk, a stand of conifer trees which are at least 40 feet tall with an average crown closure of 70 percent or more. For deer, cover may include saplings, shrubs or trees at least 5 feet tall with 75 percent crown closure.

Threatened Species - Plant or animal species that are not presently in danger of extinction but are likely to become so within the foreseeable future throughout all or a significant portion of their range.

Timberlands - See Forest Land.

Timber Base - Acres included in the calculation of the allowable cut.

Timber Production Capability Classification (TPCC) - A classification system that identifies the commercial forest land base capable of producing timber on a sustained yield basis.

Topkill - The death or dieback of the exterior portion of brush or tree crowns.

Toxicity - A characteristic of a substance which makes it poisonous.

Translocation - The transfer of substances from one location to another in the plant body.

Transpiration - The process by which plants take up moisture from the soil through their root systems and give off moisture to the air through their leaves (needles).

True Fir - A member of the genus Abies, e.g., white fir (*Abies concolor*). Douglas-fir (*Pseudotsuga menziesii*) is not a true fir.

Udic Soils - Soils which are not dry for an extended period (greater than 45 days) at 4 to 12 inches deep during most years.

Understory Species - Shade-tolerant plant species which characteristically grow beneath the forest canopy; e.g., blackberry and rhododendron.

Unit Resource Analysis (URA) - A BLM planning document which contains a comprehensive inventory and analysis of the resources within a specified geographic area and an analysis of their potential for development.

Viable Population - The number of individuals, adequately distributed throughout their range, necessary to perpetuate the existence of natural, genetically stable, self-sustaining populations.

Visual Resources - The land, water, vegetation, animals and other natural or man-made features visible on public lands.

Visual Resource Management (VRM) - Planning, designing and implementing management activities on public lands in ways that will provide acceptable levels of visual impacts.

Visual Resource Management Classes - Categories (I, II, III, or IV) assigned to public lands based upon scenic quality, sensitivity level and distance zone criteria. Class I (preservation) provides the highest level of protection for scenic values, and Class IV the lowest level.

Volatilization - The vaporizing or evaporating of a chemical substance.

Water Quality - The combined physical, chemical and biological characteristics of water bodies.

Watershed - The area drained by a given stream.

Wetland or Wetland Habitat - Permanently wet or intermittently flooded areas where the water table (fresh, saline, or brackish) is at, near, or above the soil surface for extended intervals, where hydric wet soil conditions are normally exhibited, and where depths generally do not exceed 2 meters. Vegetation is generally comprised of emergent water-loving forms (hydeophytes) which require at least a periodically saturated soil condition for growth and reproduction. In certain instances, vegetation may be completely lacking.

Wildlife Habitat Area (WHA) - The area which encompasses the major biological habitat components of any wildlife species or groups of species in a biotic community (BLM Manual 6610.05A).

Xeric Soils - Soils which are dry for an extended period (greater than 45 days) at 4 to 12 inches deep during most years.

Yarding - The act or process of conveying logs to a landing.

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